Pit and Quarry

With which is consolidated

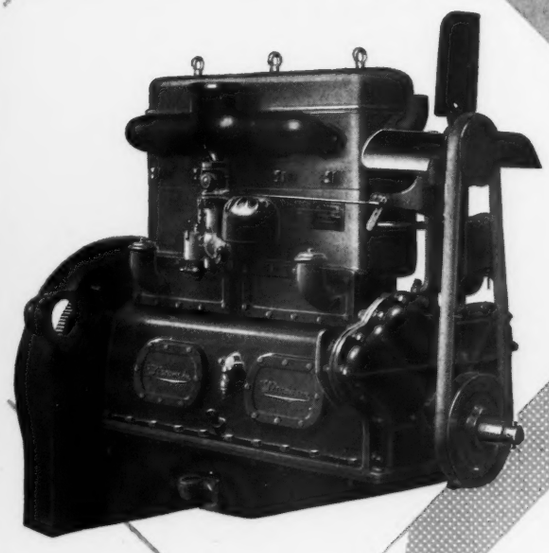
CEMENT-MILL & QUARRY

Member Audit Bureau of Circulations

Reaches Largest Number of Plants

Vol. XX **JULY 2, 1930** **No. 7**

Satisfying Smoothness



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Wisconsin engines are built around the principle of valve-in-head construction rather than adapting the principle to the engines. Painstaking engineering down to the smallest details is combined with oversize construction throughout. Power flows with satisfying smoothness . . . even under the stress of overloads and continuous work.

You can depend on Wisconsin engines for long service life, amazing flexibility, and general satisfaction . . . on any kind of a machine, on any power job. We'd like to have you be the judge. « «

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Milwaukee
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This 3-ft. by 6-ft. single deck Type "C" UNIVERSAL Vibrating Screen functions daily at the Dickason Sand and Gravel Co. Plant, Cayuga, Indiana—a subsidiary of the Brownell Improvement Company of Chicago. The plant was newly built last summer; has straight-line operation, with a capacity of 2,500 tons per day. One sand-drag box is so arranged that material under ¼-in. feeds to the UNIVERSAL, which produces a fine grade of plastering sand.

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These are a very few of the reasons why the largest number of leading firms have installed UNIVERSALS. Drop us a line. We'd like to tell you all the reasons.

See P&Q **HAND BOOK Page 242.**

UNIVERSAL VIBRATING SCREEN CO.
RACINE ~ ~ WISCONSIN

HERE GOES THE 500,000TH TON!

and still going strong

Summer and winter, day and night at times, for over six years, this veteran 50-B two-yard quarry shovel has dug gravel or rock for its owner. Recently it ripped its half-millionth ton from the ledge and today finds this Bucyrus-Erie still at it, giving the same unfailing big output at low cost, just as it did when new.

This performance is typical of the records being made in hundreds of quarries and pits with Bucyrus-Erie 2, 2½, 3, 4 and 5-yard full revolving quarry shovels. These fast, sturdy machines weren't designed in a day, nor are they general work shovels merely adapted to quarry use. They represent years of studying the needs of stone and gravel producers.

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Pit and Quarry

With which is consolidated CEMENT-MILL & QUARRY

Member Audit Bureau of Circulations

Read in Largest Number of Plants

Published Biweekly on Wednesday for Producers and Manufacturers of Sand, Gravel, Stone, Cement, Gypsum, Lime, and Other Non-Metallic Minerals.

Subscription price: $5 for 3 years, $2 for 1 year in the United States and possessions, North, Central and South America; elsewhere $1 additional for each year. Single copies 20c.

Entered as second-class matter October 9, 1928, at the Post Office at Chicago, Illinois, under the Act of March 3, 1879.

Published and copyrighted, 1930, by the

COMPLETE SERVICE PUBLISHING COMPANY
538 South Clark Street, Chicago, Illinois

H. W. BAUMGARTNER, *President* — V. E. LARSEN, *Vice-President*

S. A. PHILLIPS, *Directing Editor* — ARTHUR J. HOSKIN, *Editor*

W. E. TRAUFFER, *Assistant Editor* — G. B. MASSEY, *Associate Editor*

HARRY F. UTLEY, *Assistant Editor* — G. F. SONDRAKER, *Associate Editor*

New York Representatives:
E. M. BUCK, 68-43 Clyde St.; Telephone BOULEVARD 5259; Forest Hills, L. I., N. Y.
V. A. LESLIE, 301 W. 108th St.; Telephone ACADEMY 7990; New York, N. Y.

Cleveland Representative:
W. E. COATES, 2198 Elbur Road; Telephone BOULEVARD 0688 W; Lakewood, O.

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Trinity Installs New Quarry-Haulage Plan

USES REMOTE-CONTROLLED CARS

The Trinity Portland Cement Co. is installing a General Electric haulage system in its quarry at Eagle Ford near Dallas, Tex. The system consists of four 10-cu. yd. Atlas steel cars, each driven by two self-contained 50-hp. electric motors, operating on a mile of stnadard-gauge track and remote controlled from a single control tower.

This is probably the first installation of this kind in the non-metallic minerals industry in which alternating current is used. This makes possible the use of squirrel-cage induction motors whose inherent characteristic enables them to maintain a constant speed under all conditions. On down grades gravity converts the motors into generators, feeding current back into the power system and serving as brakes to the cars.

The tower operator controls all movements of the cars until they are at a convenient place near the shovel. The shovel operator then "spots" the car from a panel mounted on the shovel. Power for this system will be generated at 550 volts 3 phase, 25 cycles at the plant and stepped up by transformers to 2,300 volts for distribution to the haulage system and to the electric shovel in the quarry. The system is expected to be in operation about August 1.

Nashville, Tenn. Office Moved to New Location

The Hermitage Portland Cement Co., of Nashville, Tenn., recently moved its main office from 174 Third Ave. North to 902 American Trust Bldg., in that city.

Alpha Cement Plant Is in Accident-Free Group

The Morton plant of the Alpha Portland Cement Co. on June 23 completed an entire year of operation without a lost-time accident. The quarry has a record of 426 days, while some of the other departments have never had an accident.

Unusual precautions are taken at this plant to prevent accidents and all the employees are thoroughly trained in safety methods. Over 75 per cent of the employees were trained by the Bureau of Mines in its 1929 safety and first-aid instruction campaign and the plant's first-aid team won the first place cup at the regional safety meeting held in Birmingham on Jan. 22, 1930.

Charles E. Phillips, assistant superintendent, is safety director and all heads of departments are on the safety committee.

Philadelphia Quartz Co. to Build in California

The Philadelphia Quartz Co. of California has plans under way for the construction of a $500,000 plant on a 12-acre site near South Gate, Cal. A. W. Elkington, general manager of the company's plant at Berkeley, Cal., negotiated for the site, according to the *West Coast Builder*.

Case Against Portland Cement Assn. Dismissed

Because of lack of jurisdiction the Federal Trade Commission has dismissed its complaint charging the Portland Cement Association, its board of directors, officers and members with practicing unfair methods of competition. It had been charged that the association, composed of close to 100 manufacturers who make and sell about 95 per cent of the cement produced in this country, circulated statements disparaging to a method of cement road construction involving the use of vibrating machinery.

Boston Firm Expanding; Builds Ready-Mix Plant

The Boston Concrete Corp., subsidiary of the Boston Sand & Gravel Co., 88 Broad St., Boston, is carrying out an expansion program at Cambridge, Mass., for the production and distribution of ready-mixed concrete. The plant, together with equipment, will cost in the neighborhood of $70,000, according to reports.

San Antonio Concern in Transit-Mix Field

BATCHING PLANT INSTALLED

The Turner Gravel Co., which operates sand-and-gravel plants at Luxello and San Antonio, Texas, recently installed a new transit-mix batching plant at its material yard at 825 Morales St., San Antonio. This is an all-electric operation except for a ¾-cu.yd. Northwest gasoline crane which handles some of the materials.

The 160-cu. yd. Butler steel bin and weighing batcher discharge to the trucks, which have Paris transit-mixer bodies. All concrete is sold on a definite ultimate-strength basis for all kinds of construction work.

A small sand-and-gravel plant and a batching plant similar to this one were installed at about the same time at Schertz, about 30 miles east of San Antonio. This installation will furnish gravel and concrete for a large government building project near that place.

New South Wales Cement Plant Starts Production

The first unit of the new cement plant of Southern Portland Cement, Ltd., at Berrima, New South Wales, has been placed in operation with a yearly capacity of 750,000 tons. The company, which is controlled by Australian Iron & Steel, Ltd., and Howard Smith, Ltd., has its own coal mines with a daily capacity of 1,000 tons, and its own stone quarries at Marulan, from which the material is transported some thirty miles to the plant. The plant will employ 306 men.

Joliet Stone Installs Crusher and Conveyors

The Joliet Stone Co., formerly the Markgraf Stone Co., Joliet, Ill., is installing an Allis-Chalmers crusher, driven by a 150-hp. General Electric motor. Other new equipment includes a Seaverns car dumper and a 36-in. United States Rubber belt-type bucket conveyor on 66-ft. center. H. Nussmeyer is manager.

Permits for Building Continue Upward Climb

MAY ONLY 18% UNDER NORMAL

Official reports of building permits issued in May in 588 cities and towns in all sections of the United States indicate a continuation of the trend toward normal which began in April, according to S. W. Straus & Co. For the second time since October, 1929, the Straus monthly index of building permits, after allowance has been made for seasonal and trend factors, showed an upward tendency toward normal. The total volume of permits issued in the 588 centers was $202,231,771, compared with April reports of $209,054,406. Although this is a loss of 3 per cent, the normal seasonal trend of building permits from April to May shows a decrease of approximately 12 per cent.

While these figures are encouraging, it must be borne in mind that the trend toward normal which has now persisted for two months had its beginning at a very low level of building activity which is still far under 1929 levels. The May permits showed a loss of 35 per cent from May of last year.

Although the volume of building permits continues on an abnormally low level, the index of building permits during May continued the upward movement which had been noted in April, reversing for the first time a downward tendency extending over many months. This index, which is adjusted for the influence of both seasonal variations and long-term trend, was 81.3 per cent in May, or 18.7 per cent below normal, as compared with an April figure of 70.1 per cent, or 29.9 per cent below normal. In March the index reflected a volume of permits 42.6 per cent below normal.

The twenty-five leading cities of the country, measured by volume of projected building, showed during May a collective gain of 7 per cent over April, and a loss of 27 per cent from May of last year. Seventeen of these cities showed individual gains over April—Chicago, Los Angeles, Detroit, Milwaukee, San Francisco, Seattle, Boston, Pittsburgh, Oklahoma City, Providence, Louisville, Kansas City, St. Paul, Akron, Nashville, Minneapolis, and Battle Creek. Eleven of the cities registered gains over May, 1929—Cincinnati, Baltimore, Washington, Seattle, Providence, Louisville, Kansas City, Jersey City, St. Paul, Nashville and Battle Creek.

Chicago climbed from fourth place in April to second place in May with a volume of $11,697,300. Los Angeles was third, followed by Detroit, Philadelphia, Cincinnati, Baltimore, Milwaukee, Washington, San Francisco, Seattle, Boston, Pittsburgh, Oklahoma City, and Providence in the order named.

Baltimore, San Francisco, Seattle, Oklahoma City, Providence, Louisville, Jersey City, St. Paul, Nashville and Battle Creek showed gains over May, 1929.

Led by structural steel, most building material prices were reported lower on the whole for May. In spite of several large projects in some of the metropolitan areas steel awards for the country as a whole were small, with the result that prices to-day are lower than last month and considerably lower than a year ago. In some localities considerable declines were reported in common brick, lumber, sand and gravel prices. Cement prices, though soft, have not changed very much in the last few months.

Will Develop Bauxite Holdings in Arkansas

The Arkansas Bauxite Co., with temporary headquarters in Little Rock, has been incorporated to develop and commercialize bauxite holdings in the southern part of Pulaski County, Ark. Edgar G. Hanschke is president and John F. Evans is secretary.

Non-Metallic Mineral Output Again Rising

CAR LOADINGS SHOW GOOD GAIN

The production of limestone, sand, gravel, and stone is increasing, according to car-loading data collected by the Car Service Division of the American Railway Assn. The number of open-top cars of sand, gravel, and stone loaded during the week ended June 7, 1930, was 61,000, an increase of 3,490 cars, or 6.6 per cent, over the week ended May 31. For four weeks, with one exception, the loadings have shown a weekly increase.

Loadings of limestone during the week ended June 7 showed an increase over each of the preceding three weeks.

The data for all these products, by districts and by weeks, are shown in the accompanying table.

CAR LOADINGS OF LIMESTONE, SAND, GRAVEL, AND STONE, WEEK ENDED JUNE 7, 1930, BY DISTRICTS

District	Limestone	Sand, Gravel and Stone
Eastern	3,754	12,882
Allegheny	3,294	8,797
Pocahontas	691	1,481
Southern	687	8,630
Northwestern	1,382	7,839
Central Western	430	13,945
Southwestern	479	7,426
Totals	10,717	61,000
Week ended:		
May 31	10,356	57,510
May 24	9,899	53,928
May 17	10,160	54,402

Cement Company Moves to New General Offices

The Ash Grove Lime & Portland Cement Co., Kansas City, Mo., has moved its general offices to the Fairfax Building, 101 West 11th St., Kansas City, Mo., where it now occupies the entire 11th floor.

BUILDING AND ALTERATION PERMITS FOR MAY, 1930, COMPARED WITH MAY, 1929, AND APRIL, 1930, BY STATES

State	May, 1930	May, 1929	April, 1930	State	May, 1930	May, 1929	April, 1930
Alabama	$ 677,150	$ 1,147,812	$ 557,556	Nebraska	1,077,029	873,710	948,920
Arizona	521,549	638,554	856,261	Nevada	217,650	107,375	64,900
Arkansas	189,884	320,593	279,397	New Hampshire	61,781	243,167	49,204
California	19,968,785	25,676,925	17,849,734	New Jersey	7,136,954	16,518,143	9,844,955
Colorado	960,245	5,829,182	744,737	New Mexico	131,251	420,842	214,253
Connecticut	4,374,302	6,903,722	4,525,473	New York	48,132,549	61,980,059	52,607,009
Delaware	423,731	539,329	331,049	North Carolina	756,525	1,312,127	1,117,083
District of Columbia	3,032,412	2,021,245	4,778,720	North Dakota	268,277	785,080	515,033
Florida	2,926,039	4,078,337	1,653,859	Ohio	11,328,764	14,955,413	12,311,245
Georgia	675,055	1,818,645	1,157,624	Oklahoma	3,441,258	4,357,733	2,785,061
Idaho	364,029	207,642	194,341	Oregon	1,527,674	1,728,324	1,357,400
Illinois	17,750,050	44,875,858	11,444,550	Pennsylvania	10,773,831	17,857,372	16,431,309
Indiana	3,295,279	5,389,413	2,743,227	Rhode Island	2,764,290	3,225,792	1,287,625
Iowa	2,054,611	2,335,174	2,591,050	South Carolina	405,603	963,299	340,433
Kansas	1,277,512	1,441,804	1,875,324	South Dakota	177,645	341,690	444,270
Kentucky	2,409,261	1,619,458	1,097,994	Tennessee	3,366,148	2,918,961	3,904,824
Louisiana	569,166	1,649,660	643,065	Texas	5,954,426	8,618,526	7,066,786
Maine	159,861	155,770	362,265	Utah	461,606	591,702	527,820
Maryland	3,764,498	2,876,708	5,793,529	Vermont	27,000	17,000	40,000
Massachusetts	7,538,335	17,291,821	8,244,805	Virginia	1,152,191	2,332,342	1,176,421
Michigan	10,309,309	20,941,221	8,562,955	Washington	4,279,284	4,182,846	3,699,374
Minnesota	3,474,836	2,996,243	2,341,017	West Virginia	519,893	1,103,187	520,153
Mississippi	322,968	709,695	750,763	Wisconsin	6,322,479	11,569,650	6,099,898
Missouri	4,598,575	4,458,358	5,939,230	Wyoming	32,575	66,075	184,332
Montana	277,746	350,285	197,573	Totals	$202,231,771	$313,343,869	$209,054,406

Plan 1931 Meet of Sand and Gravel Men

SPECIAL SESSION FOR OPERATORS

Preliminary plans are already being made for the fifteenth annual convention of the National Sand & Gravel Association and the exhibit in conjunction therewith, which will be held in St. Louis on January 27, 28 and 29, 1931.

A novel feature is being planned for the convention. This will be in the form of a special session for plant superintendents and operating men. This session will be devoted exclusively to the practical problems of plant operation and will afford the superintendents an opportunity to discuss questions of vital importance to them and to obtain the opinions of other operating men on these subjects. A special program is being worked out by a committee of the association, of which F. A. Bingham, general manager of the Northern Gravel Co. of West Bend, Wis., is chairman. This committee will have the assistance of J. R. Thoenen, mining engineer, U. S. Bureau of Mines, and the program is expected to prove a valuable innovation.

V. P. Ahearn, executive secretary of the association, was in St. Louis on June 12 and 13, making preliminary arrangements for the convention and exhibit. He was accompanied by M. B. Garber, chairman of the manufacturers' division.

The association has applied for reduced railroad fares for the benefit of all those who will attend the convention and, while this application has not yet been approved by the railroads, it appears certain that the association will again be granted the benefit of the identification-certificate plan, which met with such success at the Memphis convention. Under this plan, all those who attend the convention and exhibit in St. Louis are entitled to a reduction of one-half of the regular return fare from St. Louis to their homes. This amounts to a substantial saving on the cost of railroad transportation.

Gordon F. Daggett Opens Offices in Milwaukee

Announcement has just been made of the opening of offices by Gordon F. Daggett, at 2404 Clybourn St., Milwaukee, Wis., specializing in the design and construction of equipment for sand, gravel, and crushed-stone plants. Mr. Daggett is a graduate civil engineer from the University of Wisconsin, and has had much experience in design and construction. For a number of years he was materials engineer for the Wisconsin Highway Commission, following which for three years he was executive secretary and consulting engineer to the commercial sand, gravel and crushed-stone producers in Wisconsin, whose plants produce a total of over six million tons per annum. Early in the year 1929 he resigned and became affiliated with the Boehck Machinery Co., Inc., of Milwaukee, as a member of the firm and its chief engineer. This connection he retains, but his many friends in the industry will welcome his opening a separate office in order to give more and better individual service. Mr. Daggett has specialized in the analysis and tests of road-building materials and expects to make this one of his strongest lines in the future.

McCroskey Enterprises in Tennessee Expanding

A further extension of the McCroskey stone by-product enterprises in Tennessee is provided in the application for incorporation of the Watauga Stone Co., capitalized at $250,000.

The company will operate two units in Carter County, Tennessee. One is to be a crushed limestone quarry at Watauga, five miles east of Johnson City, and the other a river-sand operation at Siam, five miles east of Elizabethton.

Robert S. Campbell, who is manager of the McCroskey enterprises in Tennessee, Georgia and the Carolinas, will direct the development of these two units. About $150,000 will be spent for equipment and about 100 men will be employed. Work will start in about 30 days, it is reported.

Mr. Campbell is vice-president of the new corporation; Howard Young is president; Henry McCroskey, treasurer, and Charles M. Seymour, secretary.

Valspar Corp. Acquires Detroit Graphite Firm

The Valspar Corp., pursuant to its plans of acquiring from time to time such additional units as will prove advantageous in the completion of its manufacturing facilities, announces that it has merged the Detroit Graphite Co. of Detroit, Mich., and the Dominion Paint Works, Ltd., of Walkerville, Ont., with its existing units.

Texas Plant Furnishing Washed Gravel for Dam

The W. E. Callahan Construction Co., Waco, Tex., operates a complete gravel-washing plant at San Angelo, Tex., producing aggregate for the construction of a dam. All equipment was furnished by the Smith Engineering Works, Milwaukee, Wis.

World Road Congress Attracts 37 Nations

OPENS AT WASHINGTON ON OCT. 6

Thirty-seven foreign countries have already officially accepted the invitation to participate in the International Road Congress to be held in Washington, October 7 to 10, inclusive.

The nations who will participate, to date, are as follows:

Algiers	Honduras
Belgium	Hong Kong
Bulgaria	India
Canada	Indo-China
China	Irish Free State
Colombia	Italy
Costa Rica	Japan
Cuba	Lebanon
Czecho-Slovakia	Morocco
Denmark	Netherlands
Ecuador	New South Wales
Egypt	Nigeria
Finland	Norway
France	North Ireland
Germany	Poland
Great Britain	Rumania
Greece	Sweden
Guatemala	Syria

The official opening of the congress will take place Monday afternoon, October 6, at Constitution Hall, preceded by a meeting in the morning of the International Permanent Commission at the offices of the Chamber of Commerce of the United States.

The official opening of the International Exposition will be on Tuesday, October 7. The exposition will be open each day of the convention for the inspection of the delegates. A demonstration field has also been provided where delegates may see the various kinds of equipment in actual operation. Inasmuch as all delegates will be in Washington during the entire week of October 6, there will be an excellent opportunity for them to inspect the exhibits at the International Exposition and to familiarize themselves with American equipment. This will also be of tremendous importance to manufacturers who desire to make contacts for export trade.

All sessions of the congress, except the official opening, will be held at the building of the Chamber of Commerce of the United States.

Increase Production at Paul Ales, Inc. Plant

Several important changes are being made at the Lockport, Ill., plant of Paul Ales, Inc., a subsidiary of the Material Service Corp., Chicago.

On the main tipple eight Universal vibrating screens and two Telsmith sand drags have increased production by 500 cu.yd. per day. The plant's average daily output is now 160 cars.

Fred Herkel, general superintendent, is now supervising the installation of a Monighan 4-cu. yd. dragline with a 127-ft. boom for making a new cut, estimated at 200 ft. wide and 2,000 ft. long. The dragline is also to be used for stripping.

Limestone Deposits Sold to Southwestern

PROPERTIES NEAR LOS ANGELES

The purchase of the lime properties formerly owned by the Paramount Portland Cement Co. by the Southwestern Portland Cement Co. of Los Angeles, Cal., marks a further step in the development policies of the latter company.

These properties located at Torrance, about 25 miles from the heart of Los Angeles, and midway between that city and the seaports of San Pedro, Wilmington and Long Beach, consist of 128 acres of shell deposits of varying thickness up to 300 ft., and because of their location they have become increasingly valuable. A plant erected upon them would have a distinct advantage not only from the marketing standpoint but from a distinct saving in manufacturing costs. Proximity to the large natural gas fields of Southern California insures a steady supply of fuel at costs far lower than those now experienced by their competitors.

The Southwestern company does not plan the immediate erection of a plant, but, according to C. C. Merrill, general manager, if it becomes necessary to strengthen its present position in the cement industry in this section by such action a modern wet-process plant will be constructed on these properties.

The Paramount Portland Cement Co. was formed in 1929 to take over the property formerly held by the H. H. Helbush interests of Los Angeles. The Paramount company carried on extensive drilling operations further to prove the tonnage and quality of the material in the deposits.

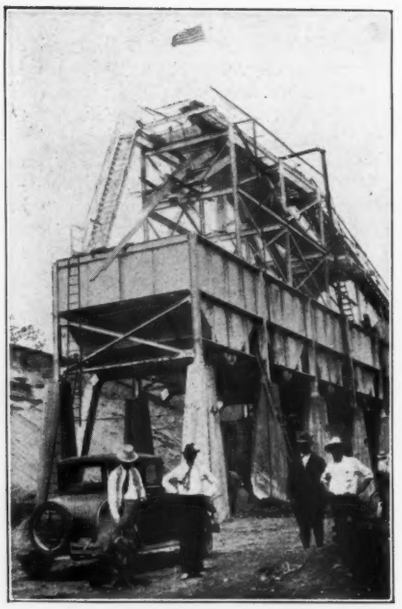
Amsco Pumps Employed at Koenig Gravel Works

According to information supplied by the American Manganese Steel Co., the pumps referred to in an article, "Operates Two Sand-and-Gravel Plants in Well-Known Michigan Area," in the May 21 issue of Pit and Quarry, are of Amsco manufacture. This story described the dredging operations of the Koenig Coal & Supply Co., Detroit.

Observe Plant Opening by Conducting Barbecue

About 1,500 persons attended the celebration held June 21, 1930, at the new plant of the Washtenaw Rock Products Co. near Manchester, Mich. The festivity was in the nature of a barbecue at which 900 lb. of beef, pork and lamb, and thousands of sandwiches were consumed. The town of Manchester declared a half holiday and was decorated with flags.

The plant is of all-steel construction, erected by the Iowa Mfg. Co. of Cedar Rapids, Ia. The output is to be 60 carloads of gravel per 10-hr. day, as soon as the construction is fully completed.



Partial view of Washtenaw plant, showing all-steel construction.

The Washtenaw company comprises C. C. Alfred, Charles Trautman, R. I. Stanton and George Matthews.

Raises Production from 60 to 100 Cars per Day

The Saxet Sand & Gravel Co., Victoria, Tex., recently increased the capacity of its sand-and-gravel plant near that city, making it one of the largest in the state. The additions include a new dredge, similar to the present one, equipped with a W. H. K. Bennett Diamond 10-in. dredge pump and a new ballast-loading plant with an Allis-Chalmers Newhouse crusher, screens and conveyors. This has a capacity of 40 cars of gravel per day.

The original plant, which had a capacity of 60 cars per day of washed and graded material, has been in operation less than two years. It was also designed by the W. H. K. Bennett Co.

Water Tank Disappears Into Old Mine Workings

Over 150 miners are out of work while officials of the Hillside Fluorspar mine at Rosiclare, Ill., said to be the largest in the world, repair damage caused when an 80-ft. water tower sank into the ground and was covered by debris. The depth the tower has sunk is unknown. The sinking was attributed to the fact that several levels of the mine had been cleared out, leaving a honeycombed effect underground, unable to withstand the pressure.

Asphalt Meeting to be Held at Memphis

PAVING CONFERENCE ON DEC. 1

At a recent meeting of the board of directors of The Asphalt Institute, held in New York, the city of Memphis, Tenn., was selected as the meeting place for the Ninth Annual Asphalt Paving Conference to be held this year, the meeting to convene on Monday, December 1, continue through December 2, 3 and 4 and close on December 5.

The Association of Asphalt Paving Technologists will, as usual, meet in conjunction with the conference.

The arrangements will be in charge of various national and local committees created for the purpose. O. I. Kruger, city commissioner of Memphis, and W. B. Fowler, Memphis city engineer, are assisting in organizing the committees which will have charge of the local arrangements. An elaborate entertainment program is being planned.

Plan to Develop Silica Deposits in California

Re-opening of the sand pits in the Mt. Diablo foothills in California between Brentwood and Byron is a development for the immediate future by the Silica Co. of California, according to an announcement made recently.

The Silica Co. of California, headed by R. M. Greathouse, recently acquired the sand pits, opened some time ago by the Merrill interests, and has awarded a contract to J. T. Lubbe of Martinez, Cal., for the building of the grade for a spur track connecting with the Southern Pacific main line east of Brentwood and extending to the sand pits, where extensive machinery will be installed for the mining of glass sand.

Mobile Ready-Mixed Co. Is Enlarging Facilities

The Mobile Ready-Mixed Concrete Co., Inc., Mobile, Ala., is installing a new 2-cu. yd. T. L. Smith concrete mixer to supplement the 1-yd. mixer now being used. The plant has been in operation about a year and has found its product in such demand that this installation became necessary.

Few other changes will be necessary, as the plant was designed so that it could be easily enlarged at any time. The new unit is expected to be in operation within 30 days. The concrete produced at this plant is being used on county, state and local building work and meets all specifications. With its present equipment and 15 trucks as much as 245 cu.yd. of concrete has been mixed per day.

Haden Lime Co. Has Modern Selling Plan

UTILIZES AD SPACE AND RADIO

The Haden Lime Co., Houston, Tex., operating one of the largest and most modern lime plants in the country and the sole producers of lime made from oyster shell in rotary kilns is also leading the way in advertising its product. The advertising program includes space in drug, chemical and other trade papers, local newspaper advertising, and direct-mail advertising by means of booklets, circulars, etc.

The company has gone a step further and, together with the other Haden interests, has a weekly radio program over Station KTRH, Houston, Tex. This program is given every Friday at 7:45 P. M., every second Friday of each month being devoted exclusively to lime.

The program is opened with a brief talk on the uses of lime, each program usually being devoted to some one particular use that might appeal to the average citizen, such as the liming of soils and structural applications. The remainder of the 15-minute period is devoted to music or other entertainment. Sidney P. Armsby, service director of the Haden Lime Co., is in charge of these programs. Mr. Armsby also personally inspects soils and offers a consulting service on the application of lime.

The other Haden interests which share in this broadcast are the W. D. Haden Co. and the Haden Co. The W. D. Haden Co. produces oyster shell with plants at Galveston and Corpus Christi and operates a sand and gravel plant at Westpoint. The Haden Co. retails a complete line of building materials in Houston and Galveston.

Huron Portland Cement Improves Radio Station

The radio room at the Alpena, Mich., plant of the Huron Portland Cement Co. has been moved from the plant itself to the plant's radio station. The building is being repaired and new equipment added. All outgoing and incoming boats are handled through this station. It is in charge of William Bradley, chief radiotrician of the company.

Utica Plant Increases Silica Sand Production

The Illinois Pulverizing Co., Utica, Ill., is planning several alterations in its equipment for producing silica sand. The deposit of white sand is excavated by hydraulicking but the increasing length of the pipe line from the face of the pit to the plant renders the installation of a larger pump advisable, so an Allis-Chalmers centrifugal pump, driven by a 50-hp motor, will be added. Also to increase and improve the washing and screening of the sand, a Leahy 4-ft. by 7-ft. double-deck vibrating screen will be installed. A new dryer is planned for future installation. All of these improvements will be made under the supervision of W. J. Witt, general supt. George F. Locke is president of the company.

Lime Quarries and Kiln Opened in Arizona Town

Sheffield, Paul & Sheffield of Perkinsville, Ariz., have placed in operation what is considered to be the most modern plant of its kind in Arizona.

The limestone quarries and kilns succeed the plant at Puntenney and, when working at capacity, will employ about 50 men.

Indiana Gravel Company Working 18 Hours a Day

The sand-and-gravel plant of Sturm & Dillard, near Syracuse, Ind., has been working from 15 to 18 hours a day, since May 15.

According to C. H. Purdum, manager of the plant, most of the washed gravel is being used by the B. & O. Railroad for ballast on its track system in Indiana.

Southern Quarries Will Erect Building, Runway

Southern Quarries of Elberton, Ga., are reported to be planning the erection of a 40-ft. by 200-ft. plant building. A steel runway for an electric crane of 20-tons capacity is also to be built, it is said.

Installs Washing Screens in Flood-Control Plant

To produce suitable material for use in controlling floods, the U. S. Engineers' office, Memphis, Tenn., is to install two Telsmith-Hercules 48-in. washing screens in a plant near Memphis.

Gravel Firm Installing New Vibrating Screens

The Montgomery Gravel Co., Montgomery, Ala., is erecting a new unit to replace an obsolete portion of its sand-and-gravel plant. Vibrating screens are being installed.

Asphalt Co. Opens Plant Near Breckenridge, Tex.

The American Asphalt Co. recently erected a gravel plant at Breckenridge, Tex., with a capacity of 30 cu. yd. per hr.

Producer of Shells Buys Diesel Dredge

WILL OPERATE IN LOUISIANA

The Jahncke Service, Inc., New Orleans, La., operating shell dredges in various lakes in that vicinity and sand and gravel plants at Roseland, La., and Brookhaven, Miss., as well as a number of material yards in New Orleans, is building a new dredge, the *Tchefuncta*, to be used on construction work for the government. The dredge is 150 ft. long by 47 ft. wide and has a 20-in. Ellicott centrifugal pump. The pump is driven by a 1,000-hp., 8-cyl. DeLavergne-Diesel engine while a 300-hp. engine of the same make operates the generator furnishing power for the smaller units.

The dredge will be used in the construction of the Bonne Carre spillway connecting the Mississippi River and Lake Ponchartrain. This will be 3½ miles long and vary in width from 1½ to 2 miles. Control gates at the river end will allow diversion of high water from the Mississippi River into Lake Ponchartrain which is directly connected with the Gulf.

Foundations Fail Due to Lack of Soil Knowledge

That the failure of foundations for structures is often due to insufficient understanding of the safe bearing value of the soil, and the failure to apply safe practices of foundation engineering, was the contention of C. C. Whittier, of the engineering firm of the Robert W. Hunt Co., Chicago, in an address delivered recently before the annual convention of the National Scalemen's Association, held in Chicago.

"Soil is subject to natural variation that must be determined before a foundation can be designed that will prevent dangerous unequal settlements from the dead weight of the structure and the live load or other disturbing elements," Mr. Whittier declared.

Mr. Whittier pointed out other salient facts of foundation engineering in his address, which proved extremely interesting and informative to those who heard it. The Robert W. Hunt Co. will be glad to send copies of the complete talk to those who write and ask for it. The company is located at 2200 Insurance Exchange Bldg., Chicago.

Texas Potash to Build Refinery and Sink Shaft

The Texas Potash Corp., Dallas, Tex., is reported to be contemplating the erection of a refinery and shaft on its deposits in Texas. The improvements will enable production at the rate of 1,000 tons per day.

Alabama Firm Builds New Producing Unit

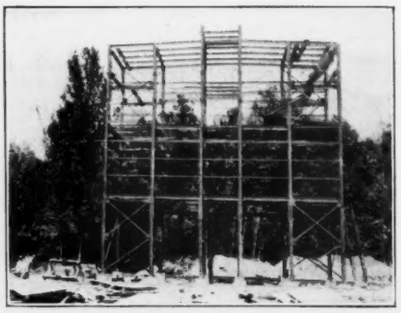
OPERATING PLAN IS DESCRIBED

The Montgomery Gravel Co., Montgomery, Ala., one of the leading southern producers, is building a new 4,000-cu. yd.-capacity sand-and-gravel plant which should be one of the outstanding plants in the south, not only because of its modern and permanent type of construction but because of its extreme simplicity of operation. It is being built on a 580-acre property adjacent to the two older plants of the company about 10 miles northwest of Montgomery. The deposit has been tested to a depth of over 50 ft. and is all good gravel.

The 12-in. Amsco dredge now being used at the newer of the two present plants will be used for the new plant. This dredge is only 2 years old and is in first-class condition. The older plant, having an 8-in. dredge, will be abandoned when the new plant goes into operation which will be about July 15.

J. A. Hanners, supt., Montgomery Gravel Co., beside one of the new screens.

The plant is all steel with concrete foundations. The steel, including sand boxes, chutes, etc., was all furnished and erected by the Virginia Bridge and Iron Co., while the concreting and installation of machinery was done by the company's forces under supervision of J. A. Hanners, general superintendent.

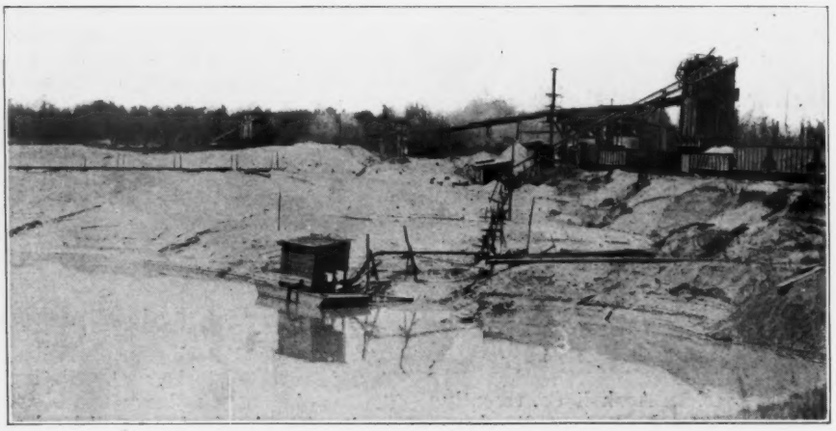


New plant of Montgomery Gravel Co. under construction.

The dredge line will discharge at the top of the plant, a head of about 50 ft., into a steel box which breaks up the force of the flow. This box discharges through two gates onto two large spreading tables. These each discharge through split chutes to two stationary screens which take out excess sand. Each of these in turn discharges to one of four 3-ft. by 8-ft. Niagara 3-deck vibrating screens.

These each produce three sizes of gravel and sand. The gravel goes directly into bins and the sand to two 12-ft. by 24-ft. steel settling tanks for the two grades of gravel. These discharge directly into cars on tracks underneath. The five gravel bins have a total capacity of 10,000 tons and also discharge into cars on tracks below.

In case of a breakdown to one side of the plant the surge box can feed to the other side alone as each half can handle the capacity of the dredge. The layout is also very flexible as each side can turn out different sizes at the same time. Another feature is that the plant can be torn down and re-erected at another location in less than two weeks. It is estimated, however, that this will not be necessary for at least five years because of the depth of the deposit. A crusher will be installed later to reduce the oversize of which there is a small amount. C. B. Ireland, president, and J. A. Hanners, designed the plant.



When the new plant (in distance) is completed, the Montgomery Gravel Co. will abandon the present plant (right).

Natural Gas as Kiln Fuel Grows in South

USED IN ALABAMA LIME PLANTS

The use of natural gas for fuel in lime and cement plants is increasing rapidly in the southern states. It has been used successfully for a number of years in Texas and some of the adjoining states but it is only recently that its use has spread to points more remote from the source of the gas.

Among the latest to adopt the use of natural gas for kiln fuel are the lime plants in the Calera district of southern Alabama. The fuel is furnished by the Southern Natural Gas Co. from its Monroe, La., fields at a pressure of 150 lb. This is reduced at the plant to the desired pressure for burning, generally about 1 lb.

The first to install a natural-gas burning system was the Saginaw Lime and Stone Co. of Saginaw, Ala., which is using it on all eight of its kilns. Open-end burners are used ranging from 2 to 4 in. in diameter while gas outlets are from ¼ to ½ in. diameter depending on the capacity of the kiln.

The Cheney Lime Co., at Landmark, Ala., recently installed a natural gas burner in one of its six kilns and will soon do the same with the remaining five. The Keystone Lime Works, Keystone, Ala., is also using gas.

Lets Contracts for New Cement Plant in Mexico

Contracts for construction of a 500-bbl. cement plant were signed on June 5 by Francisco S. Elias, governor of Sonora, Mexico, who is also president of the Cemento Portland Nacional, S. A., for the construction of the complete plant to be built at Hermosillo, Sonora, Mexico, by the Macdonald Engineering Co. of California.

Contracts were also signed with the Traylor Engineering & Manufacturing Co. of Allentown, Pa., for the cement-making machinery and with the Diesel-electric power plant.

The Southern Pacific Railroad Co. of Mexico is at work putting in the necessary sidings and as soon as this track work is completed, so that the construction equipment can be moved in, the work of building the plant will be rushed to completion. The plant is being designed so that additions can be readily installed to bring its capacity to 750 or 1,000 bbl. per day as the market may warrant.

Dimensions of Vulcan Locomotive Corrected

The Vulcan 12-ton gas-electric locomotive made by the Vulcan Iron Works is 13 ft. 6 in. in length and 7 ft. in width. In a description of this machine published in a recent issue of PIT AND QUARRY these dimensions were incorrectly given.

Pit and Quarry

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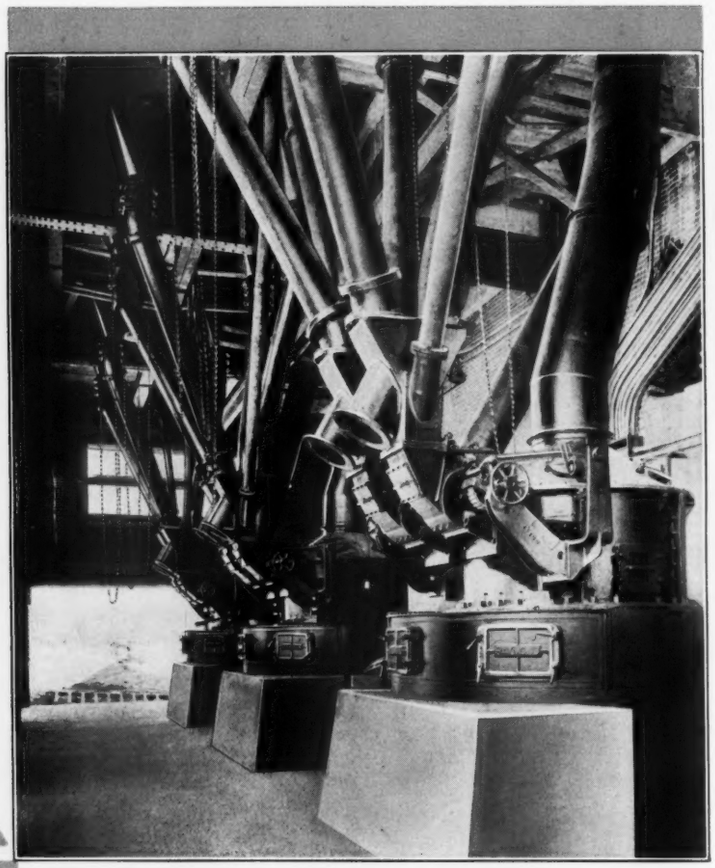

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Arkansas' Only Producing Cement Plant Embodies Simplicity and Safety

Low First Cost and Low Operating Cost Are the Results of Careful Designing

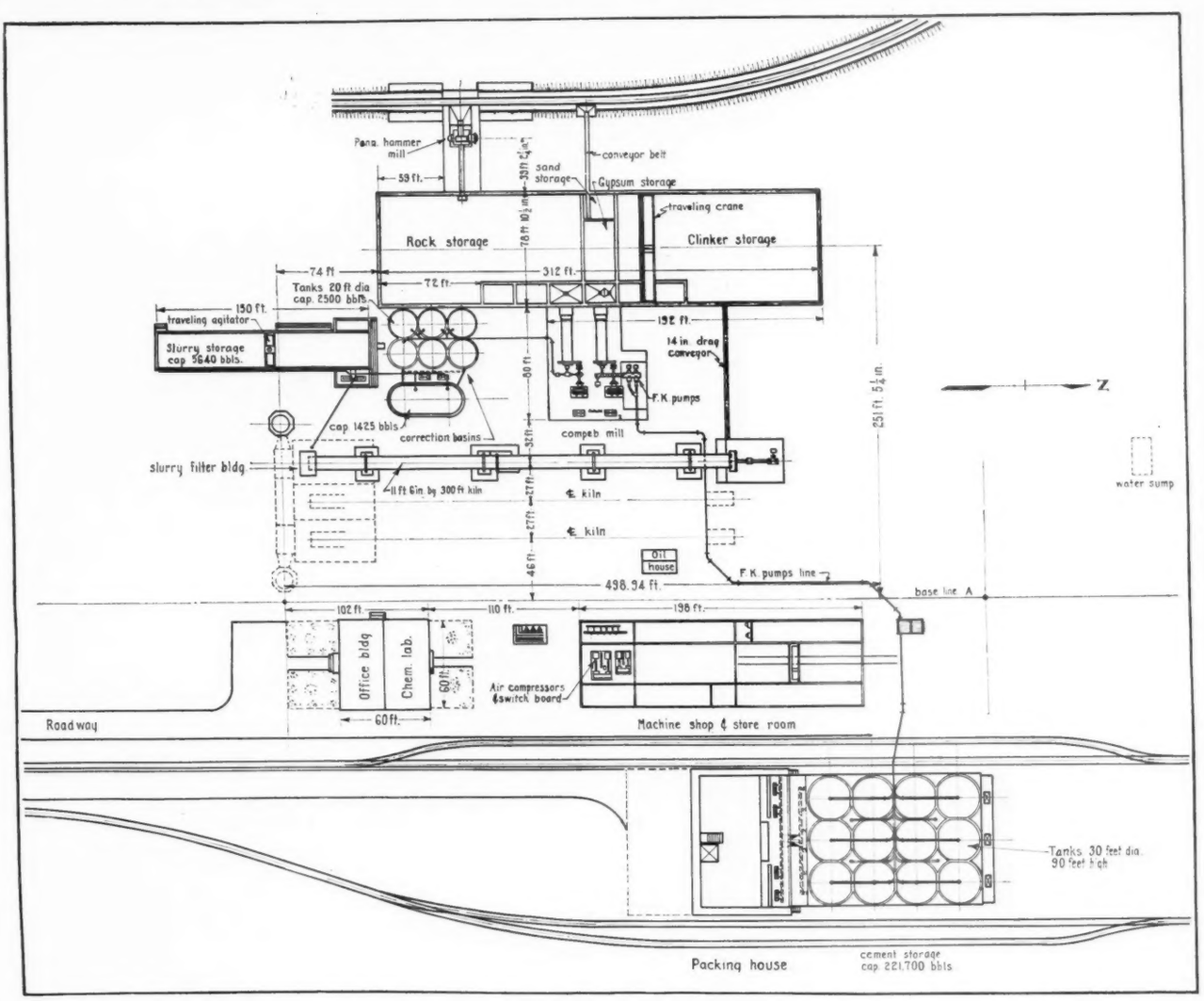
By W. E. TRAUFFER

ARKANSAS' only producing cement plant was put into operation last autumn and, except for a few minor shutdowns, has been operating since at full capacity. The new 2,500-bbl. plant of the Arkansas Portland Cement Co. is located at Okay, Ark., in the southwestern part of the state. It is 35 miles northeast of Texarkana and 125 miles southwest of Little Rock.

The idea of building this plant was conceived by Charles Boettcher, president of the company, about three years ago. Mr. Boettcher noticed the extensive road-building program planned by the state and became interested in the potential market for cement. After paying a visit to Arkansas he became convinced that there were suitable deposits of raw material in the state for the operation of a cement plant.

He then sent Murrell Mathews, at that time local manager of the Oklahoma Portland Cement Co., to investigate the various deposits in this region. Mr. Mathews did this in a thorough manner and found that the best raw materials lay in a chalk deposit in the southwestern part of the state. This deposit was carefully examined and several sites considered.

The present deposit was finally selected for a number of reasons. The raw materials were found to be perfect for the manufacture of cement, and



General plan of Arkansas Portland Cement Co. plant.

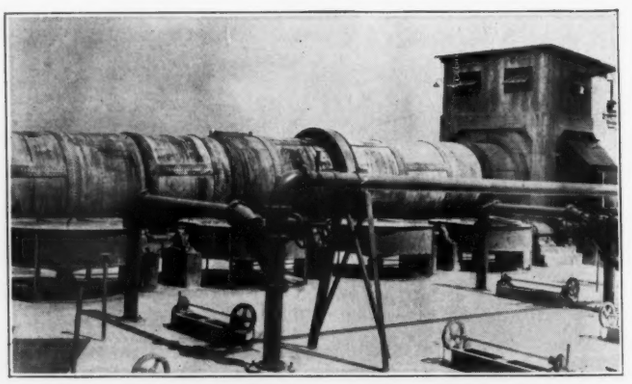
Plant as viewed from top of water tank.

both materials, chalk and clay, occur close together in an advantageous position for quarrying. There were also such commercial features as access to transportation and markets, access to electric power and natural gas, and the natural site for the plant and village.

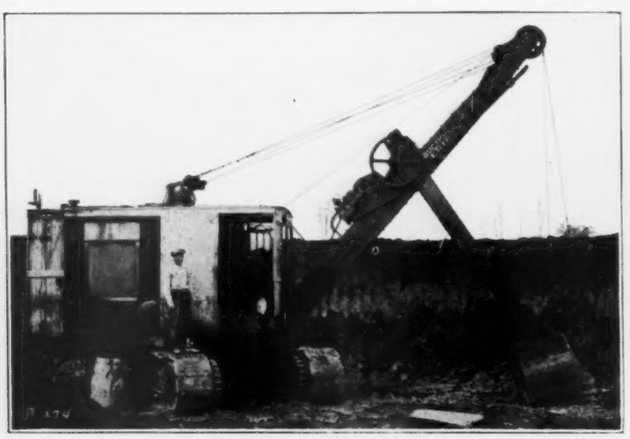
History and Construction

After the deposit was selected, work on the plans for the plant was begun in July, 1928. Before construction could be started it was necessary to build a spur line to the Graysonia, Nashville & Ashdown Ry., at Schaal, 4.8 miles away, so that construction material could be brought to the plant site. This was completed in the middle of November, 1928.

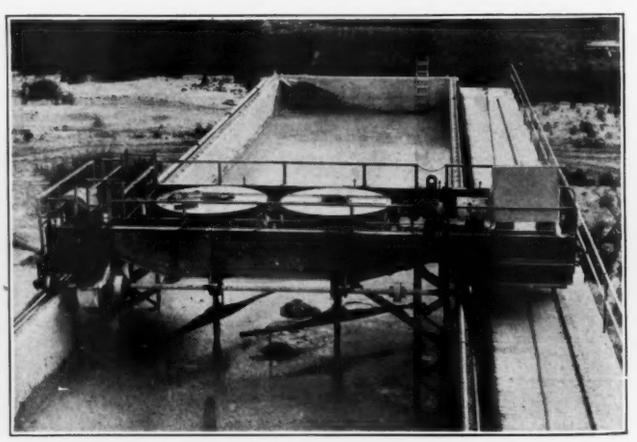
Clearing of the plant site and preparations for construction were begun immediately. The first concrete was poured during Christmas week, 1928, and construction pushed so rapidly that the crushing plant was ready to be started on June 18, 1929. The raw-grinding department was started on Aug. 12, the kiln on Aug. 18, the finish-grinding mill on Aug. 25, and the first cement was packed Sept. 12, 1929. The opening day was Oct. 2, when the first



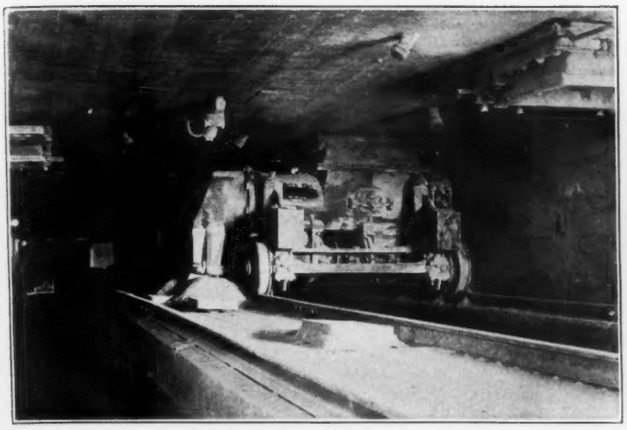
Quadruple agitator above slurry tank, and feed end of kiln.



Gasoline-air shovel loading clay.

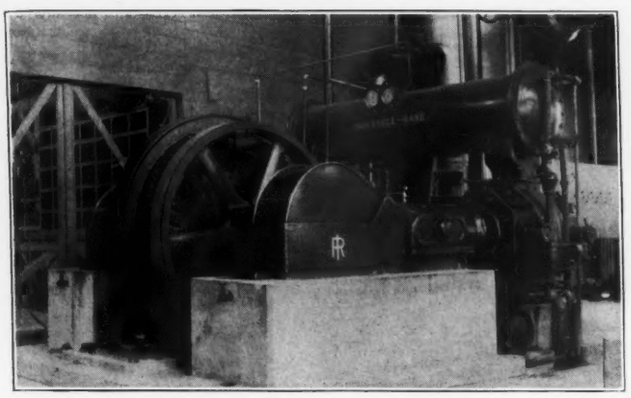


Slurry-storage tank with traveling agitator.



Transfer of cement from storage silos to collecting screw conveyor.

Motor, speed reducer and table feeder to raw mill.



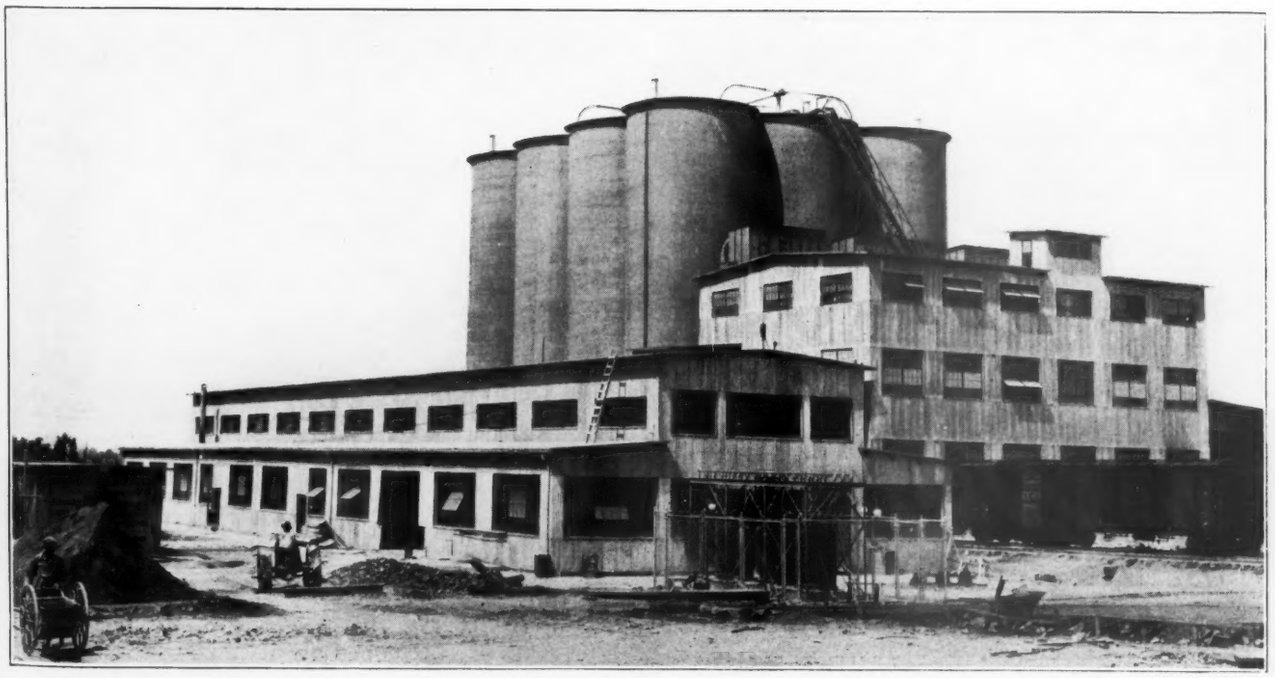
One of the large compressors.

shipment of approximately 125 carloads was made.

The foundations of all the buildings are of reinforced concrete poured in solid rock. The majority of the buildings have structural-steel framework and corrugated-metal siding and roofing. All concrete work except the kiln stack was done by the company's forces. The silos were poured with sliding forms and were built in ten days of continuous pouring. The steel work throughout the plant was furnished and erected by the Kansas City Structural Steel Co.

The outstanding feature of this plant is its compactness, which was attained without sacrificing space for future enlargement and without crowding. Space was left for two additional kilns and the necessary grinding mills, and the east wall of the rock storage was so designed that additional feed bins for these mills can be installed. The present stack is large enough for two kilns but, if a third be added, a second stack will be necessary. The present stack is also designed so that a waste-heat power-plant can be installed at any time.

The plant is also extremely simple from a mechanical standpoint. There are only four principal machines: the crusher, the two Compeb mills, and the kiln. Outside the packhouse there are one



Machine shop, packhouse and silos.

Showing the landscaping in the company's village. Silos in background.

screw conveyor, one bucket elevator, one drag-chain conveyor, and one belt conveyor. All these features combined account for the unusually low first cost and operating cost. The former was attained in spite of the fact that the best of equipment was used and no skimping done at any point. The latter is due largely to the small amount of labor needed to operate the plant. This latter factor also makes the plant an unusually safe one.

The plant was designed by and erected under the supervision of Paul C. Van Zandt, chief engineer of the Ideal Cement Co. J. F. Kaufman was superintendent of construction and is now plant superintendent. Mr. Van Zandt also designed and built the Boettcher plant of the Colorado Portland Cement Co., at Fort Collins, Colo., which went into operation several years ago and, previous to that time, he completely rebuilt the Portland, Colo., plant of the Ideal Cement Co.

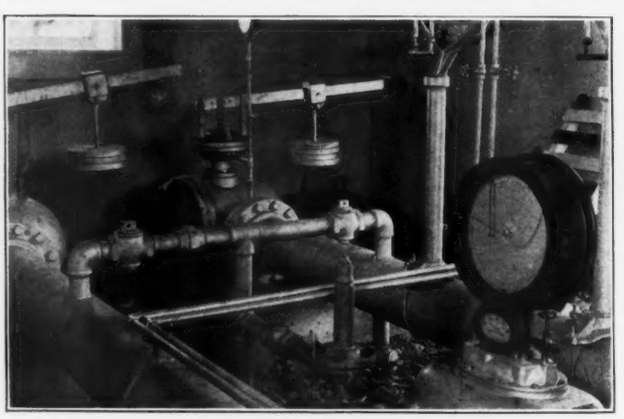
Although this is the only operating Portland-cement plant in the state, it is not the first. About the beginning of the century a vertical-kiln cement plant was built at Whitecliffs, seven miles northwest, and this produced a good quality of cement. The plant, however, was too far in advance of its market and the transportation facilities were inadequate, so it went out of existence in 1906.

Deposit and Quarry Operations

The deposit from which the plant is supplied is Annona chalk, perhaps better known as Austin chalk. The formation is fan-shaped, extending from western Florida through southwestern Arkansas and central Texas back to the Gulf of Mexico. Geologists think it was the old shoreline of the Gulf in prehistoric times. The company owns outright about 1,200 acres of this deposit.

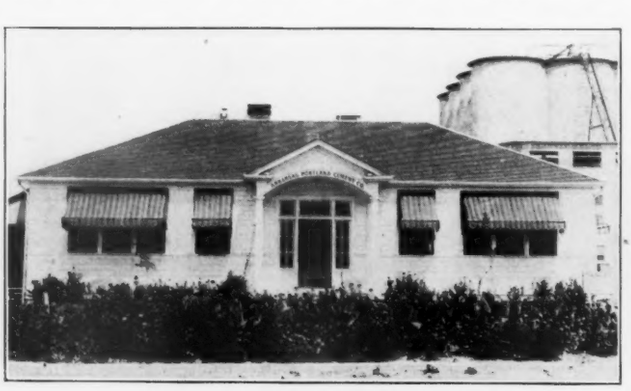
This is one of the few commercially workable deposits in the state with a lime content high enough for cement. The chalk itself varies little in lime content, but minute clay seams cause a variation between 60 per cent and 90 per cent calcium carbonate with an average of about 85 per cent. The clay is an argillaceous loam lying adjacent to and in some places above the chalk.

The quarry has not yet been sufficiently developed so that the desired method of quarrying can

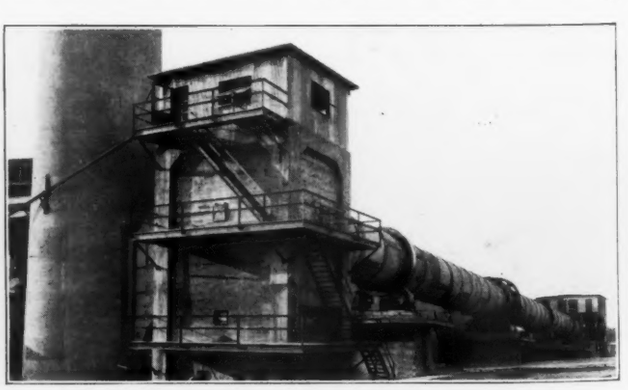


Interior of gas-pressure reducing house.

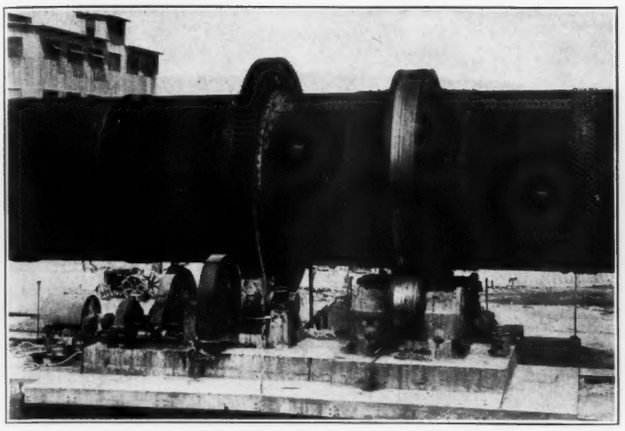
be employed. It is eventually planned to work a 40-ft. face, making bank shots of about 100 holes in staggered double rows. An Armstrong 6-in. gasoline well drill, Hercules 30-per cent gelatin, and Cor-



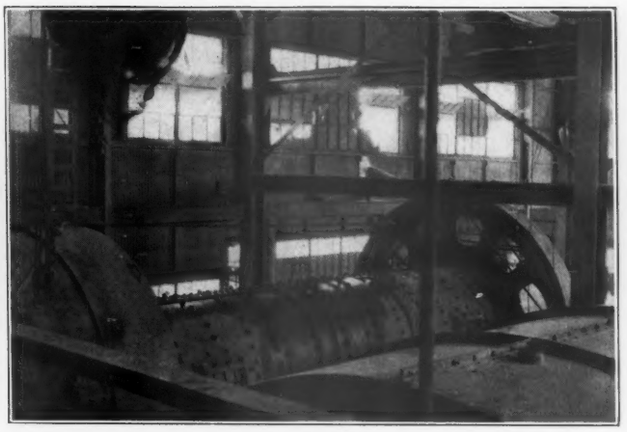
The plant office.



Stack (left) and kiln viewed from the feed end.



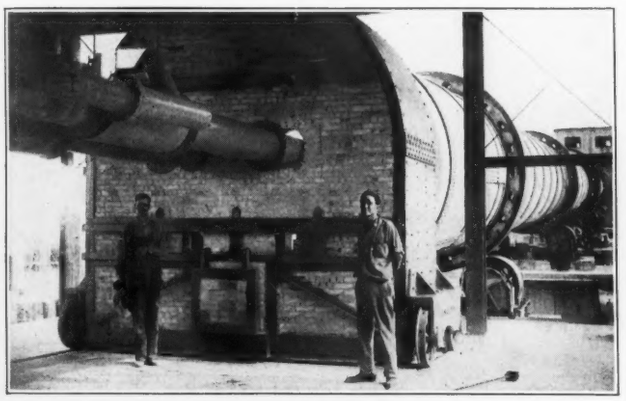
Close-up of kiln gear-drive.



Finish-grinding mill (center), raw mill (foreground), and 5-ton crane.

deau-Bickford safety fuse are used. No secondary drilling is necessary, all large stones being broken up by "dobing."

A Marion type 480, 2½-cu. yd. electric crawler shovel loads the rock into 10-cu. yd. capacity steel, side-dump cars. These are hauled to the plant by a 60-ton steam locomotive. The clay is loaded by a Bucyrus-Erie ¾-cu. yd. gas-air shovel and hauled to the plant by the same equipment.



Firing end of kiln.

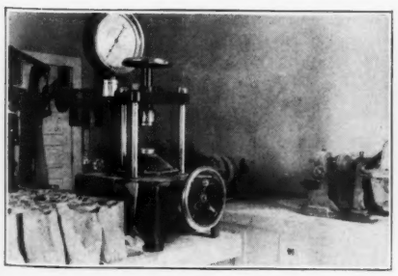
The present quarry-haulage system is temporary. Some time in the autumn, when the quarry has been developed sufficiently to make it practical, an electric haulage system will be installed. Plans are being drawn for this system which will be controlled from one tower.

Raw Material Crushing and Handling

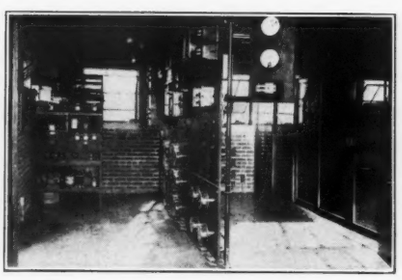
The locomotive hauls the cars a distance of about 2,000 ft. and up on a trestle, where the cars containing stone are dumped by a Shepard electric hoist into a steel-lined hopper. A Pennsylvania reciprocating feeder discharges the material into the Pennsylvania No. 60 swing-hammer mill which reduces fragments up to 36-in. cube down to 1-in. size and under. A scraper plate on the crusher keeps the breaker plate clean and prevents choke-ups when wet material is being crushed. The crusher discharges into a 42-in. Link-Belt pan elevator on 75-ft. centers, and this discharges the crushed stone directly into the rock storage where it is distributed by an overhead crane equipped with a clamshell bucket.

The reciprocating feeder is driven through a Link-Belt speed reducer and a silent-chain drive of the same make by a 40-hp. motor. The hammer mill is direct-driven by a 400-hp. slip-ring induction motor, the scraper plate by a 25-hp. motor through Link-Belt silent-chain drive and a speed reducer, and the elevator by a 40-hp. motor through a silent-chain drive. A 15-ton Whiting traveling overhead crane above the crusher and elevator is used for installing and handling repair parts.

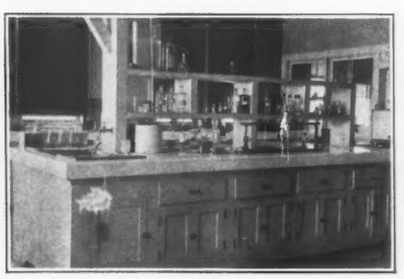
Cars of clay are dumped into a hopper feeding a 36-in. belt conveyor which discharges into the same section of the storage as the stone but in a separate pile. The stone and clay are generally quarried on alternate days or as required. The clay belt is driven by a 10-hp. motor through a Cleveland worm-gear speed reducer. The storage is 312 ft. long by 78 ft. wide and is spanned by a Milwaukee 8-ton overhead traveling crane equipped with a 3-cu. yd. Owen clamshell bucket which rehandles all stored material.



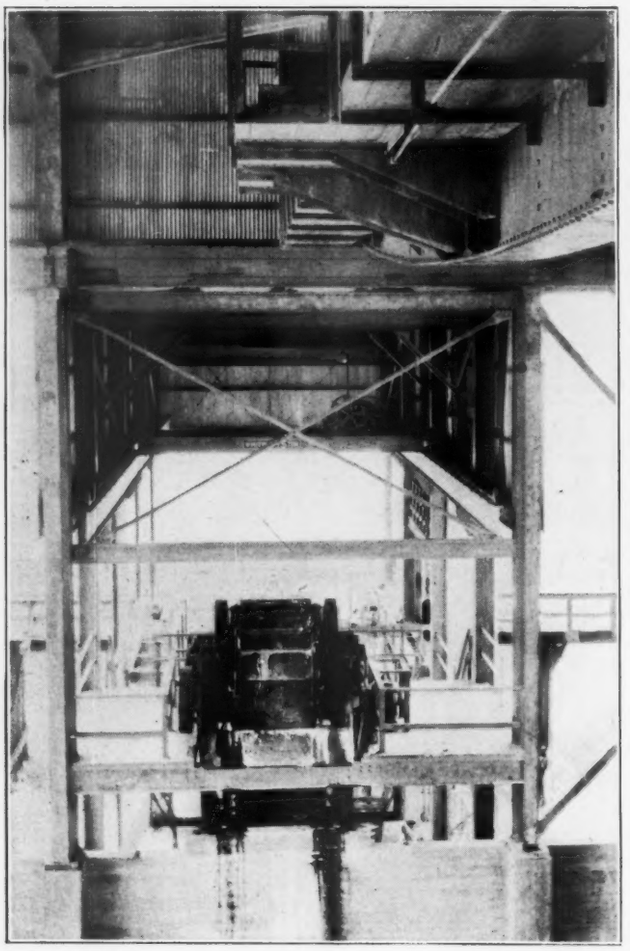
Interior, physical testing laboratory.



Interior of substation, carrier-current telephone (left), and control panel.



Interior, chemical laboratory.



Elevator from crusher to storage, 15-ton crane (background), and 8-ton crane (upper right).

The storage is divided into four compartments which are separated and enclosed by concrete walls. The largest compartment, with a capacity of 10,000 tons, is used for rock storage. The clinker storage has a capacity of 70,000 bbl., and the gypsum and sand compartments 1,000 tons and 500 tons, respectively.

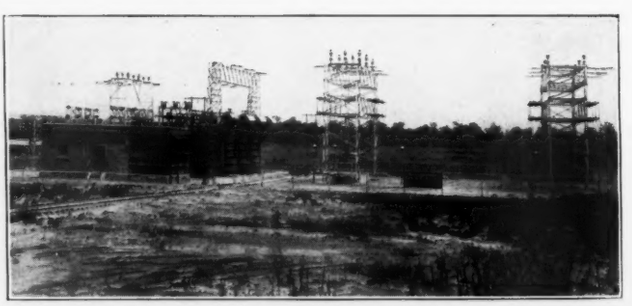
Gypsum is received in box cars from Oklahoma and is unloaded on the same track as the stone and clay but at a different point. A Stephens-Adamson power scraper feeds to a 24-in. conveyor which discharges directly to storage. Some silica sand is used to raise the silicon-dioxide content. This is secured locally and unloaded from gondola cars by the same power scraper that unloads the gypsum. The same belt conveyor discharges the sand to its storage section. The sand in the mix also prevents, to some extent, the clinker rings which ordinarily form in the kilns.

Electric shovel loading in quarry.

The crane handles the rock, clay and sand into a 150-ton-capacity steel hopper, proportioning them roughly with the bucket. This hopper feeds through a 9-ft. Allis-Chalmers table feeder to a 32-in. by 12-ft. pug mill with 17 sets of paddles on a 5-in. shaft. The pug mill discharges into the 8-ft. by 7-ft. by 40-ft. Allis-Chalmers 3-compartment raw-grinding Compeb mill. This has forged-steel balls in the first compartment with 1¼-in. and ⅞-in. Concavex, respectively, in the other two compartments. The slurry is ground to a fineness of 92 per cent through a 200-mesh screen. The table feeder is driven by a 10-hp. motor through a Foote speed reducer, and the pug mill by a 20-hp. motor through a Cleveland worm-gear speed reducer and Link-Belt silent-chain drive. The Compeb mill is direct gear-driven by an 800-hp. high-torque 2,300-v. Allis-Chalmers motor which will start under full load.

Slurry Mixing and Correcting

The slurry from the Compeb mill discharges to two 4-in. Wilfley pumps which feed to any of six 400-bbl.-capacity concrete batch tanks alongside the rock-storage section. These tanks are 20 ft. in diameter by 18 ft. deep and are equipped with F. L. Smidth mechanical and air agitators. Each series of three agitators is driven by a 25-hp. motor through a Link-Belt herringbone-gear speed reducer.



Transformers and switchboard house.

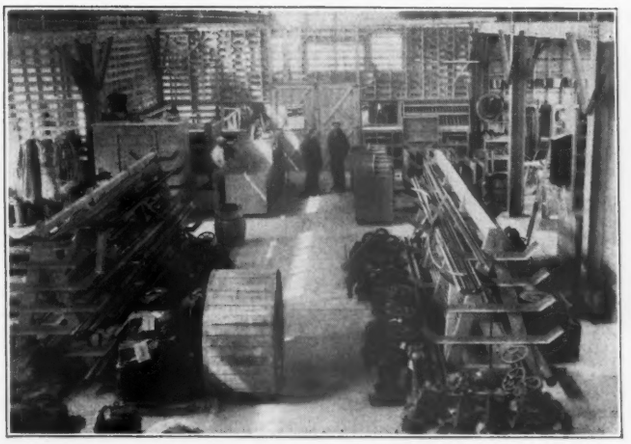
Two 4-in. Wilfley pumps transfer the slurry in the correct proportions for the desired mix into a 1,425-bbl.-capacity concrete mixing tank with round ends. This is equipped with a Smidth quadruple agitator which is driven by a 25-hp. motor through a Link-Belt herringbone-gear speed reducer.

The slurry after correction in the mixing tank is transferred to the 5,640-bbl.-capacity open-top concrete slurry-storage tank. This is 150 ft. long by 25 ft. wide and has an F. L. Smidth traveling mechanical and air agitator. The travel is maintained by a 5-hp. motor through a Cleveland worm-gear speed reducer, while the three agitators are driven from a shaft by a 10-hp. motor through a Foote speed reducer. The slurry moisture is kept at 47 per cent.

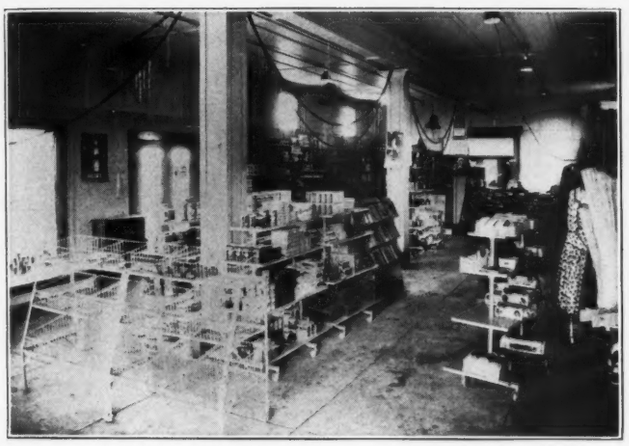
Two 4-in. Wilfley pumps feed the slurry from the storage tank to an Allis-Chalmers Ferris-wheel feeder to the kiln. All the Wilfley pumps are direct-driven by 40-hp. motors except the two feeding from the raw mill which are driven by 30-hp. motors. The Ferris-wheel feeder is driven through a James speed reducer by a 5-hp., d.c., variable-speed motor which will operate at any speed between 450 and 1,800 r.p.m.

Kiln and Slurry Filter

The Allis-Chalmers rotary kiln is 11 ft. 6 in. in diameter and 300 ft. long. It is lined through its entire length and is fired with natural gas at 3-lb. pressure. A mixer of the company's own design



Interior of store room.

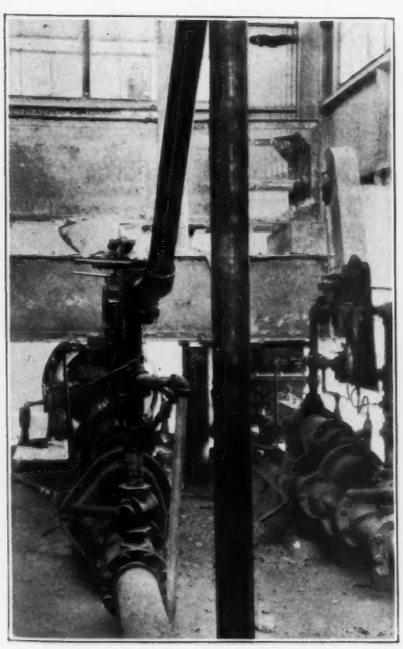


The company's grocery store.

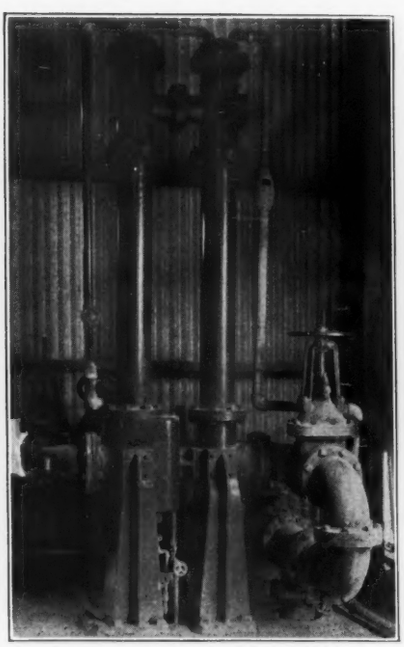
mixes gas and air in the correct proportions for perfect combustion and feeds to a 26-in. burner. A Vulcan Iron Works Stilphan 100-in. centrifugal fan furnishes air. The kiln is driven through open-gear reduction by a 125-hp., variable-speed motor which can be regulated to drive it at a speed of from 1.36 to 3.45 minutes per revolution. The fan is driven by a 100-hp. motor. The concrete kiln stack is 225 ft. high and is lined through its entire length. A Western Cartridge Co. gun is used for shooting out clinker rings.

A three-unit Oliver-United slurry filter is being installed and is expected to increase the capacity of the kiln from 2,400 bbl. to 3,000 bbl. per day. Each of the units consists of 12 disks 12 ft. in diameter. The total filter area is 7,800 sq. ft. This installation will reduce the slurry water content from 47 per cent to 26 per cent which, in addition to increasing the kiln capacity, will result in lower stack temperatures and decreased fuel consumption.

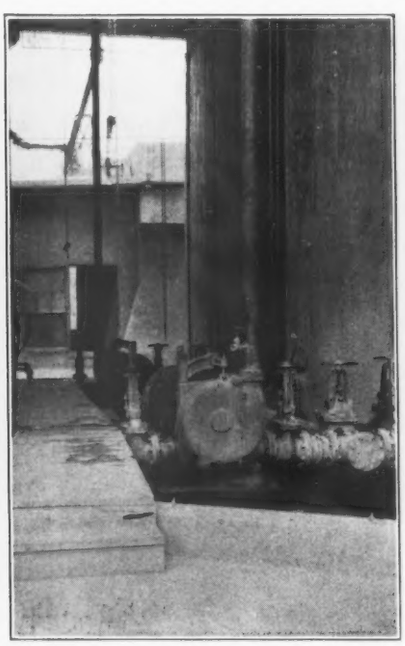
The Ferris-wheel feeder now feeding directly tc the kiln will feed the filter. The slurry cake will be discharged from the filter to a 30-in. belt conveyor. This will discharge to a Bessemer-type feeder which will feed through holes in the shell into the kiln. This is said to be the largest kiln in



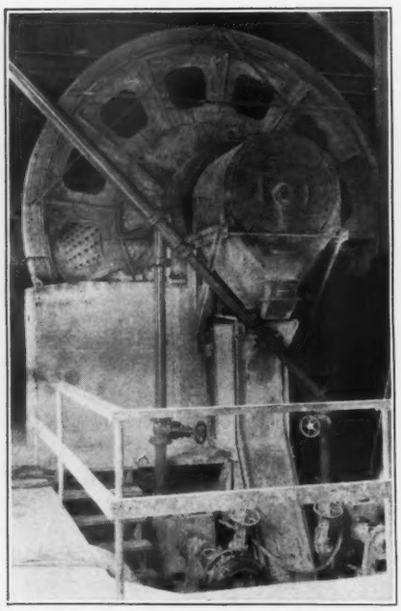
Two cement pumps and screw conveyor from finish mill above.



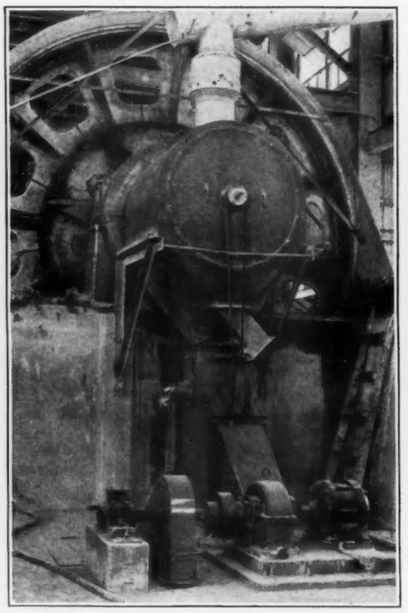
After-cooler for cement pumps.



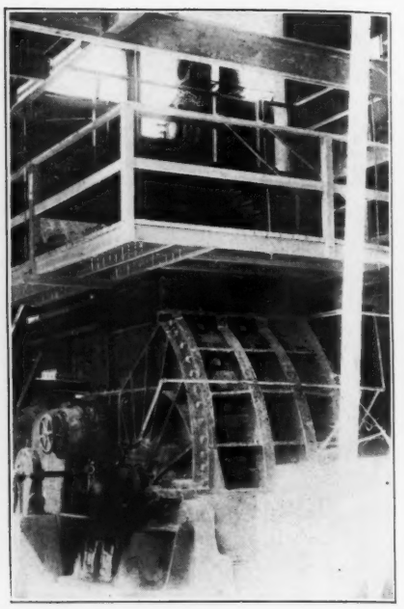
Two pumps that transfer slurry from batch tanks to mixing tanks.



Discharge end of finish mill, and pumps which handle slurry to batch tanks.



Drive end of finish-grinding mill, speed reducer, and motor drive for screw conveyor.



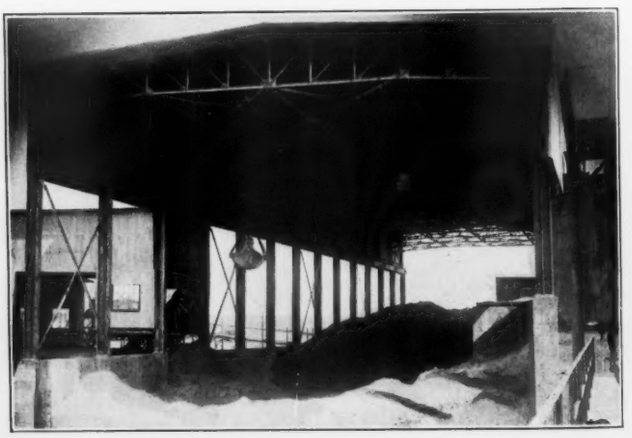
The primary crusher which reduces quarry stone to under 1-in. in one operation.

the world on which filters have ever been installed. The installation will be made with a loss of only 10 days' operation of the kiln.

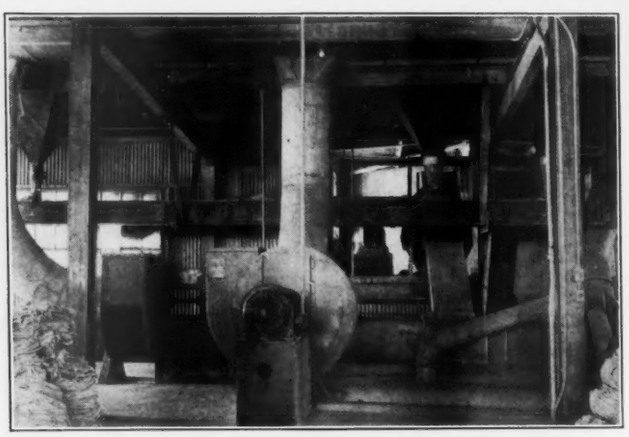
The red-hot clinker discharges from the kiln to a 14-in. Link-Belt manganese steel drag-chain conveyor. This has 112-ft. centers and is driven by a 20-hp. motor through a Cleveland worm-gear speed reducer and Link-Belt silent-chain drive. It operates in an open concrete trough and is equipped with water sprays to facilitate cooling. The conveyor discharges to a Link-Belt malleable-iron bucket elevator, with 14-in. by 8-in. buckets, which discharges directly into the clinker storage. The elevator is on 21-ft. centers and is driven by a 10-hp. motor through a Cleveland worm-gear speed reducer. This equipment is in duplicate.

The cooled clinker and gypsum are fed from their respective compartments by the overhead crane into a 2-compartment steel bin over the finish-grinding mill. This bin holds 560 bbl. of clinker and 30 tons of gypsum. The clinker is fed by a 36-in. Allis-Chalmers table feeder and the gypsum by an Allis-Chalmers reciprocating-screw feeder into the 8-ft. by 7-ft. by 40-ft. Allis-Chalmers 3-compartment Compeb finish-grinding mill. This has an outside peripheral screen and pick-up pipes between the first and second compartments.

The clinker and gypsum feeders are driven from the same 3-hp. motor through a Foote worm-gear speed reducer. This arrangement allows the rate of feed to the finish-grinding mill to be varied without affecting the proportions of clinker and gypsum. The finish-grinding Compeb mill, like the raw-grinding mill, is direct gear-driven by an 800-hp. high-torque 2,300-v. Allis-Chalmers motor which will start under full load. A 5-ton Milwaukee electric crane over the Compeb-mill motors is used for handling repair parts and a Chisholm-Moore 3-ton electric hoist handles the grinding media for the mills.



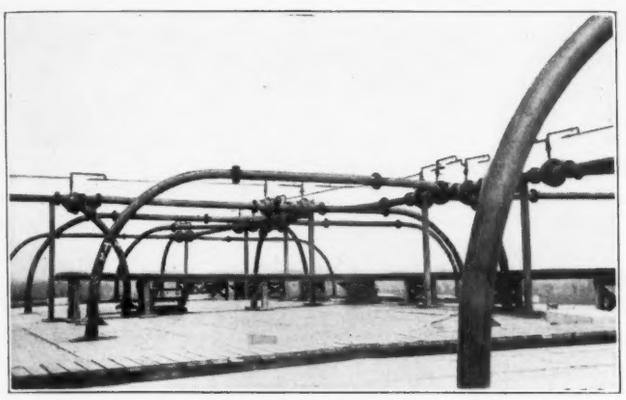
Top of elevator from crusher discharging to storage.



Two of the fans for collecting dust in the packhouse, screw conveyor to packers, and cement elevators (background).

The cement discharges from the finish-grinding mill into a 16-in. collecting screw conveyor feeding two Fuller-Kinyon pumps—one 6-in. and one 8-in. These are direct-driven by 75-hp. and 125-hp. motors, respectively, and are fitted with an Ingersoll-Rand type BM2 after-cooler and a 3-ft. 6-in. by 9-ft. air receiver. These, together, with a Wright-Austin moisture separator, insure a constant supply of clean, dry air to the pumps. The collecting screw is driven by a 10-hp. motor through a Link-Belt herringbone-gear speed reducer and chain.

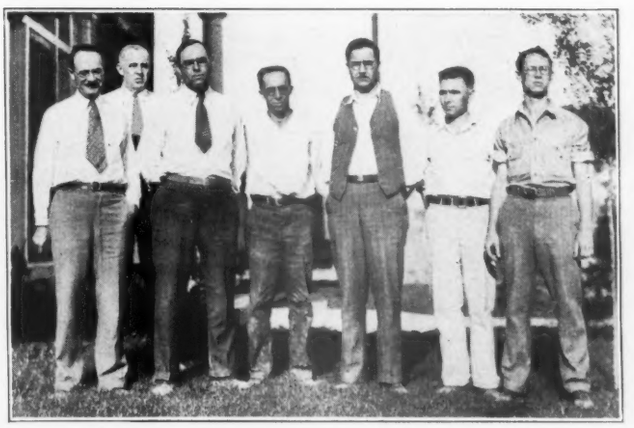
A second finish-grinding Compeb mill of the same size as the present one is being installed to take care of the increased kiln capacity developed by the slurry filter and of any future needs. This installation is being made without interference with operations and will be completed about July 15, 1930.



Piping, above silos, for cement pumping system.

Cement Storage, Packing and Shipping

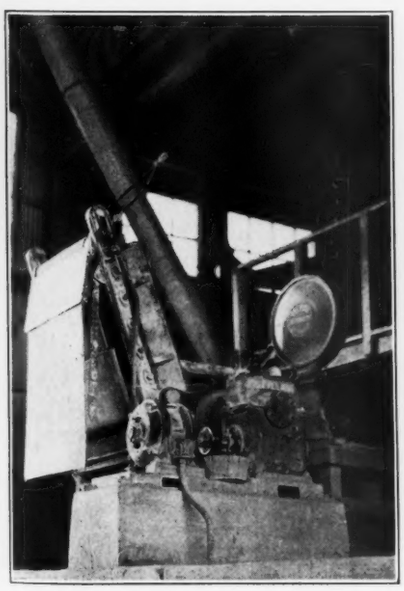
The Fuller-Kinyon pumps discharge the cement through 570 ft. of 5-in. line to the cement-storage silos, where pipes and valves allow distribution to any silo desired. There are 12 concrete silos each 30 ft. in diameter by 90 ft. high which, together with their 6 star bins, have a total capacity of 230,000 bbl.



Left to right: Paul C. Van Zandt, chief engineer; Fred Emerson, shipping clerk; J. F. Kaufman, supt.; Don Milligan, construction engineer; H. A. Abrams, chief clerk; George Kerras, draftsman; Claiborne C. Van Zandt, mechanical engineer.

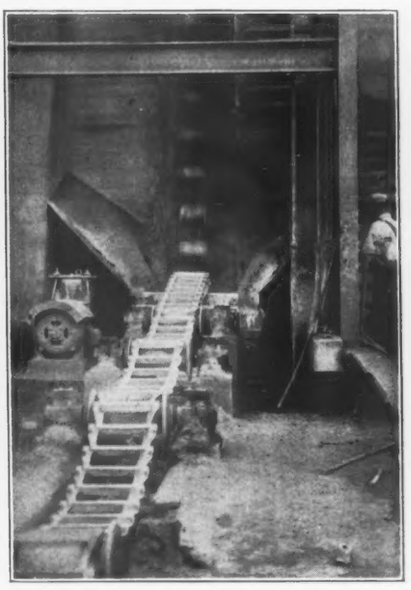
The silos are arranged in three rows of four, each row having two tunnels running the full length. Two F. L. Smidth Exbiners operate on rails in these tunnels and feed the cement to six 8-in. screw conveyors running the full length of the tunnels. These, in turn, discharge to two 18-in. collecting screw conveyors, each serving three tunnels. The Exbiners are moved from tunnel to tunnel as desired on carriers running on rails along the ends of the tunnels. The six tunnel screw conveyors are driven by 60-hp. 2,300-v. motors and the two collecting screws by 15-hp. motors through Link-Belt silent-chain drives. Each Exbiner is driven by a 5-hp. General Electric motor.

The two collecting screws discharge to two bucket elevators, with 8-in. by 18-in. buckets, in the pack-

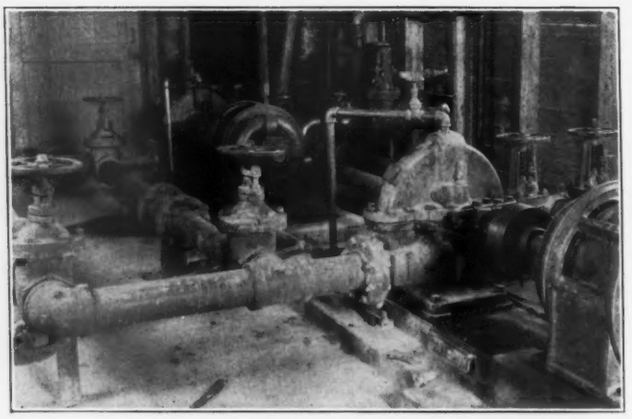


Belt for loading sacked cement into cars, speed reducer, and dial scale.

Pan elevator discharging to crushed-stone storage and overhead crane.



Drag-chain conveyor for handling hot clinker, and bucket elevator.



Pumps that handle the water supply for plant and community.

house. These discharge to two 18-in. distributing screw conveyors feeding four steel cement hoppers over the packers. The distributing screws have revolving screens (with 3/16-in. slots) attached to them. Each of the four cement hoppers discharges into a Bates 3-tube bag-packer. Each pair of packers discharges to a 30-in. horizontal belt conveyor, one to each side of the packing building, so that cement can be loaded simultaneously into cars on either side of the building. At the end of each of these conveyors is a belt extension for loading directly into cars. Bag weights are checked on Toledo springless dial scales. The distributing screw over the packers can discharge also to a rubber tube for loading bulk cement into cars. The tracks are on a grade sufficient to allow cars to be spotted by gravity.

The packing building is a 3-story concrete structure. The second floor houses a Vulcan rotary sack-cleaner which discharges to a belt conveyor leading to the sorting table. The sacks are repaired and bundled by a Bates bag tier and sewing machines and taken to the third floor for storage by an Otis 2,500-lb.-capacity freight elevator.

A three-unit Sly type A-360 dust-collecting system collects the dust from the packers and cleaners. A collecting screw returns the dust to the cement elevators. The spill from the packers also is returned by a screw conveyor. Each dust-collecting unit has an American size 60 fan which is driven by a direct-connected 15-hp. General Electric motor.

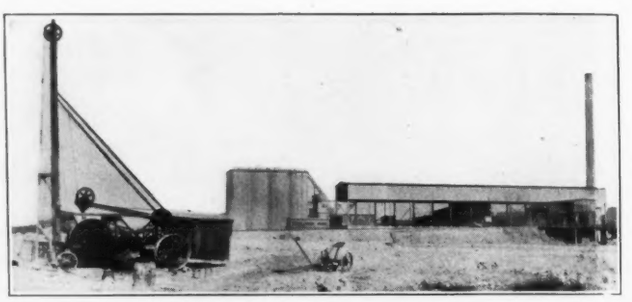
Each cement elevator is driven by a 15-hp. motor through a Cleveland worm-gear speed reducer, each distributing screw by a 10-hp. motor through a Link-Belt herringbone-gear speed reducer and chain, and each sack-loading conveyor by a 5-hp. motor through a Cleveland worm-gear speed reducer. The screen screw is driven by a 5-hp. motor through a Link-Belt herringbone-gear speed reducer and the sack-cleaner by a 10-hp. motor through a Link-Belt silent-chain drive.

Shipments are made over a 4.8-mile sidetrack to the Graysonia, Nashville & Ashdown Ry. (controlled by the company), a 27-mile road connecting with the Kansas City Southern Ry. and the Frisco Ry. at Ashdown and with the Missouri Pacific Ry. at Nashville, allowing shipments in all directions.

The Allis-Chalmers Mfg. Co. furnished most of the major equipment for this plant, including the kiln, Compeb mills, feeders, motors, and plant transformers. The Link-Belt Co. furnished the belt, chain and screw conveyors, bucket elevators, silent-chain drives, and some of the speed reducers. Conveyor belting was furnished by the Western Belting Co. General Electric Greenfielduct White conduit is used throughout, as are Crane valves and fittings.

Office and Laboratories

The building housing the plant offices and the chemical and physical laboratories is an attractive frame structure with concrete foundations. This building and the entire village are attractively landscaped, the flower gardens and trees already adding



View from west, well drill in foreground.

greatly to the appearance of the property. This beautification work was done and is maintained under the supervision of Mrs. Van Zandt, who has done a job that a professional landscape gardener might well envy.

The laboratories are equipped to make any necessary tests. The chemical laboratory is finished in white and well lighted. All the tables and benches have tile tops. The equipment includes a Chainomatic analytical balance, various mixed balances, a Sargent calorimeter for gas analysis, Barnstead electric water-distilling apparatus, Sargent electric drying ovens, and a well-designed burning hood for the residue-gas burners.

The physical testing laboratory also is a model of its kind. The equipment consists of a Tyler Ro-Tap sieve shaker, a Tinius Olsen tensile-testing machine, an Abbe ball mill, a Braun pulverizer, and a Fisher compression-testing machine for 2-in. by 4-in. cylinders. The work benches are unusually large, as is also the moist closet which has ample storage for tests. This closet has a Frigidaire unit to maintain the desired temperature and an atomizer to regulate the humidity. A Brown recording pyrometer records the temperature at the feed end of the kiln which averages about 950 deg. F.

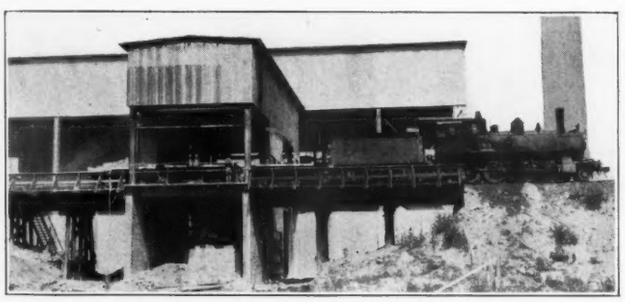
Typical analyses of the raw materials, chalk and clay, the clinker and the cement are appended, together with average tensile and compressive-strength test results, in pounds per square inch.

Analysis				
	Chalk	Clay	Cement	Clinker
SiO_2	8.30	24.46	19.80	20.80
FeO_3	1.40	2.45	2.33	2.88
Al_2O_3	2.42	7.59	6.31	6.72
CaO	47.51	30.15	66.36	68.09
MgO	.35	.88	1.20	1.30
Loss	39.80	33.04	1.39	....
N. D.	.22	1.45	.81	.21

Tensile Strength		Compressive Strength	
1:3 Sand		Neat	1:3 Sand
1 day ....230 lb.		435 lb.	1 day ....1,496 lb.
3 days....348 lb.			3 days....3,684 lb.
7 days....410 lb.			7 days....5,375 lb.
28 days....475 lb.			28 days....6,000 lb.

The machine-shop, compressors and parts storage are located in a large building which is centrally situated to make it readily accessible from all parts of the plant. The machine-shop is equipped with drills, lathes, presses, and other machinery to do any kind of repair work. A Milwaukee 10-ton, 27-ft. 6-in. span overhead electric crane handles all parts. The storage room contains a complete set of tools and large and small repair parts.

The compressor house contains an Ingersoll-Rand Class PRE2 duplex 26-in. by 16¼-in. by 18-in. air compressor rated at 2,195 cu. ft. per min., which is driven by a 350-hp. General Electric synchronous motor. Another duplex compressor of the same make and type has 20-in. by 20½-in. by 14-in. cylinders and is rated at 1,300 cu. ft. per



Dumping cars to primary crusher. Motor and drive below track.

min. This is driven by a 225-hp. General Electric synchronous motor. These compressors furnish air at 125-lb. pressure for slurry agitation and for operating the Fuller-Kinyon pumps and the air-lift deep-well pumps.

Two Ingersoll-Rand XRE1 vacuum pumps with 27-in. by 14-in. cylinders are being installed for use with the slurry filters. Each of these pumps is driven by a 150-hp. Allis-Chalmers synchronous motor.

A small room in this building houses a Westinghouse switchboard controlling the 2,300-v. current from the main substation. This is distributed to the various large plant motors and to three Allis-Chalmers 440-v. 333-kva. transformers at a small substation outside the building. A 35-kw. Allis-Chalmers motor-generator set supplies 125-v. direct current for excitation of the vacuum-pump, slurry-feed and filter motors. All motors over 50 hp. are 2,300-v. machines and all smaller motors run on 440-v. current. A 2,300-v. line goes from the switchboard to three smaller transformers over the slurry-mixing tanks. These reduce the current to 440 v. for all the motors at that end of the plant, which is most remote from the switchboard.

Power

Electric power is purchased from the Southwestern Gas & Electric Co. A transmission line was built from Nashville, a distance of 15 miles, to the plant at a cost of over $100,000. Current at 66,000 v. is supplied to the plant substation, which was built at a cost of about $200,000.

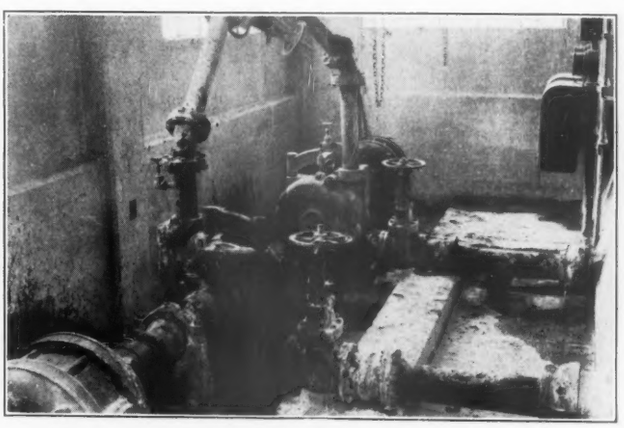
The substation has four 4,000-kva. auto-transformers with a capacity exceeding 16,000 hp. These reduce the voltage to 2,300 for delivery to the plant. They also interconnect the 66,000-v. current with a 110,000-v. line built to the plant by the Arkansas Power & Light Co. This interconnection not only assures continuous service for the cement plant but also provides two-way feed to all the towns in southwestern Arkansas served by these two companies. It also makes possible the interchange of power between the two companies for their peak loads and the purchase of power from and by either of the companies.

A feature of this installation is the Westinghouse carrier-current telephone which keeps both systems in constant communication. This is a comparatively recent development and this installation is one of the few in existence. A radio wave is impressed on the transmission lines and conversation is carried on as by wireless except that it is directed along the transmission line. It makes possible conversations between any points on the systems and effects a considerable saving in communication cost, especially in case of trouble.

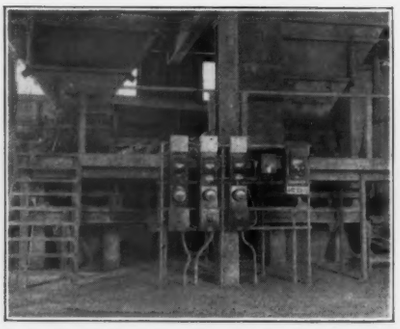
The substation is fully automatic and is protected from lightning by arresters operating at 132,000 v. Circuit breakers open the line in case of overload or lightning that passes the arresters.

Village

The company erected a modern village of 50 attractive houses for its employees. Each house is equipped with gas, water, electricity and sewer.

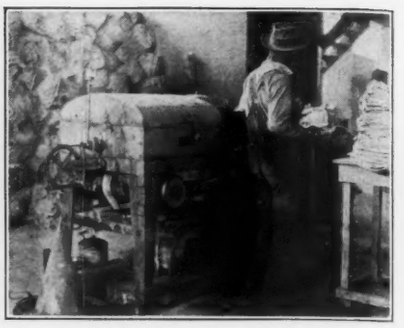


Pumps that handle the slurry from storage tank to kiln feed.



One pair of baggers and conveyor to cars.

Bag-sorting conveyor (left), rotary cleaner (background).



Bag tier with sack storage in background.

The rent is low. Each tenant has a stall in a large garage near the center of the village. Most of the houses have 5 or 6 rooms, but there are a few larger ones for the plant officials.

There is a large clubhouse in which Mr. Van Zandt and his family and some of the single men in the office reside. Guests or visiting officials of the company are accommodated here. Across the street from the clubhouse is the village store, erected by the company and leased. A complete line of groceries, meats and other things generally found in stores is carried. There is also a completely equipped soda fountain. The second floor of this building is a large assembly hall for dances, moving pictures or meetings.

The company erected a grade school which was said by state school authorities to be the most up-to-date and best-equipped rural school in the state. For the older children there is a high-school at Saratoga, 3 miles away. There is a well-equipped playground for the children.

As chief engineer of the Ideal Cement Co., Paul C. Van Zandt remodeled the Portland, Colo., plant, designed and erected the Boettcher, Colo., plant, and installed complete waste-heat equipment in the Superior, Neb., plant.

He has been engaged continuously in cement-plant engineering since his graduation from Purdue University in 1899. For eighteen years he was on the engineering staff of the Allis-Chalmers Mfg. Co., and participated in the development of tube mills, ball mills, compartment mills, two-support kilns, and especially complete equipment for wet-process plants. As cement-plant expert for the company he visited nearly every cement plant in the United States and Canada, and many plants in remote countries, including Japan and China.

His practical engineering experiences date from the steam engine and line-shafting to the present complete electrification of cement plants, from the universal packing of cement in barrels to the latest practices in pneumatic handling and automatic packing.

Gas

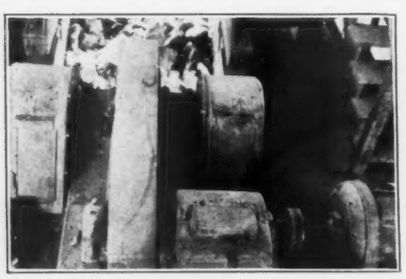
Natural gas which is used for firing the kiln and for domestic purposes is furnished by the Arkansas Natural Gas Corp., which laid a 10-in. line from Emmett, Ark., a distance of 28 miles, to the plant. This line delivers gas to a reducer house at the plant at 180-lb. pressure. Two Emco reducers step this down to 30 lb. and two Foxboro recording flowmeters record the amount and temperature of the gas used. A line for the village has a reducer which lowers the pressure to 15 lb., an Emco combination recording meter, and a Chaplin Fulton Mfg. Co. reducer which brings the pressure down to 5 oz. for domestic use.

The 30-lb. main line to the plant is controlled by two Darling 8-in. valves and a safety release valve which pops off at 50-lb. pressure. The pressure is further reduced at the plant to 3 lb. for firing the kiln.

Water and Sewage Disposal

Water for the plant and village is pumped from five 500-ft. artesian wells by air lifts. These discharge into two concrete-covered sumps, one of 6,000-gal. capacity for drinking water, and one of 11,000-gal. capacity for process water. Two Ingersoll-Rand Cameron 300-g.p.m. centrifugal pumps feed from the sumps to two large steel water tanks on high ground at the far end of the village. One of these tanks,

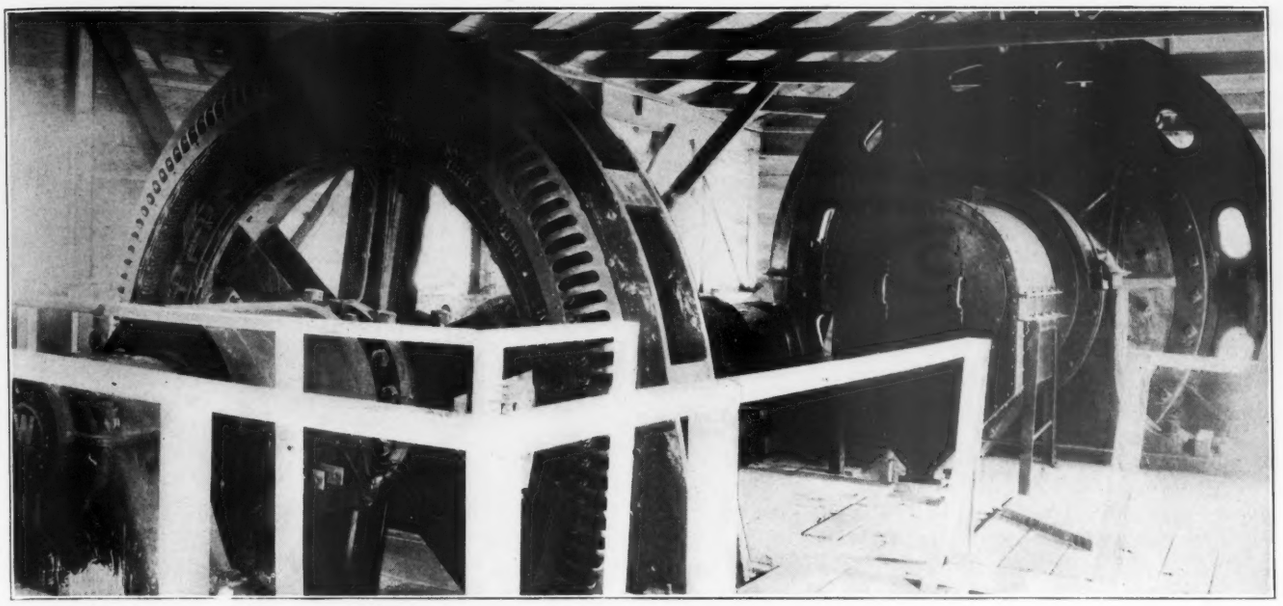
(*Continued on Page* 56)



Motor, chain drive, and speed reducer for feeder to primary crusher.

Gypsum and clinker feeder to finish mill, with worm-gear reducer.

Ferris-wheel kiln feeder, and speed reducer.



Super-synchronous motor and tube mill for raw grinding.

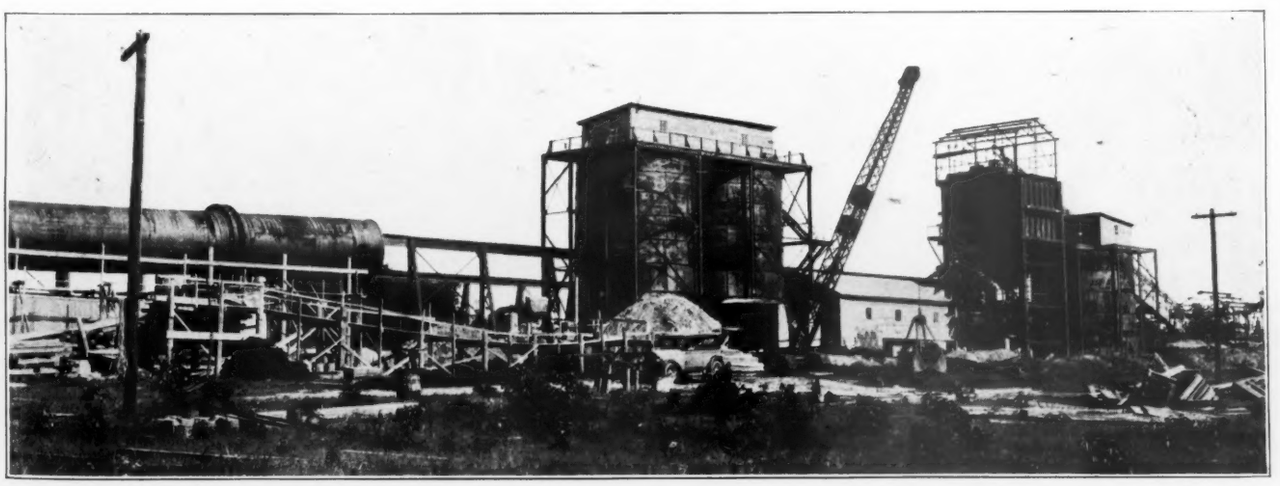
New 2,000-Bbl. Wet-Process Cement Plant Nears Completion in Southwest

Output of This Straight-Line Operation Will Probably Be Doubled Early in 1931

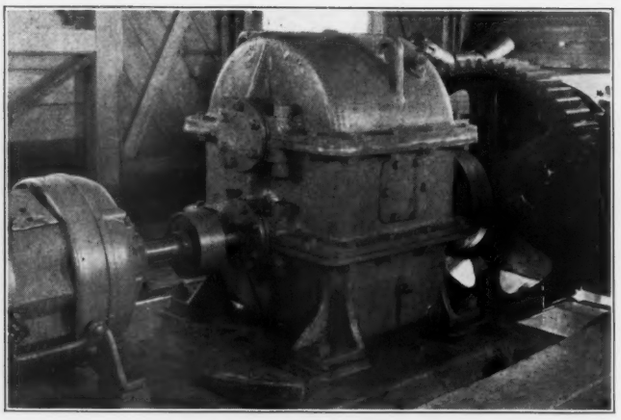
THE NEW PLANT of the American Portland Cement Co. Inc., which is under construction at Foreman, Ark., is about three-quarters completed and could be put into production at any time on three-months' notice. All the important pieces of machinery such as kilns, tube-mills and crushers, are installed, and a large part of the smaller equipment is either installed or on the ground ready to be installed. No definite date has been set for the commencement of operations.

The plant is a straight-line operation with an initial capacity of 2,000 bbl. per day but is so designed that another kiln and two tube-mills can be installed at any time to double this capacity. Foundations for these additional units were poured when the present units were installed, and the enlargement will probably be made early in 1931.

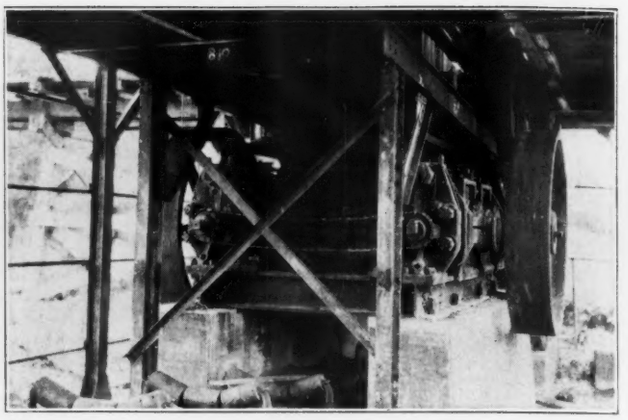
The general design of the plant was made by Lee Hunt and the Kennedy-Van Saun Mfg. & Eng. Corp., and the detailed designs by C. M. Loveland,



View of plant from northwest, showing kiln, crane runway, slurry tanks, tube mill, rock storage, and clay tanks. Gasoline crane (center).



Motor drive of conveyor No. 1.



Slugger roll primary crusher with pan feeder above.

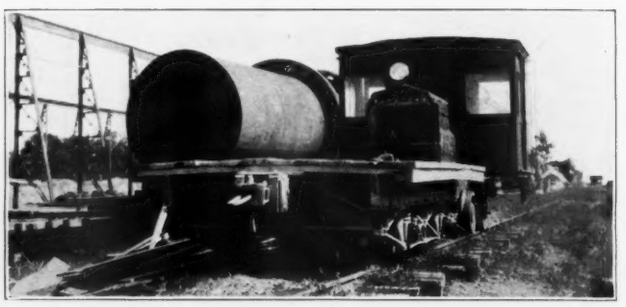
chief engineer for the cement company, who is in charge of construction and is expected to be superintendent when the plant is completed. The plant is connected with the Frisco Ry. by a ⅜-mile siding.

The company owns a 300-acre deposit one mile west of Foreman, 160 acres of which will be quarried first. There is very little overburden and the deposit consists of a high-grade soft, chalky limestone running as high as 96 per cent pure calcium. The deposit has been drilled to a depth of 600 ft. without reaching its bottom and without disclosing any variation in the quality of the stone.

Well drills will be used and a moderately high quarry face will be worked, blasting in double-row, staggered bank-shots. A Byers 1½-cu. yd. gasoline shovel will load the material into cars. This shovel, at present, is equipped as a crane with a 1-cu. yd. Owen clamshell bucket and is used for grading and assisting in the erection of the plant. The shovel will load into 6-cu. yd. Continental side-dump cars hauled by a Davenport 16-ton steam locomotive and a Whitcomb 10-ton gasoline locomotive, which are on hand.

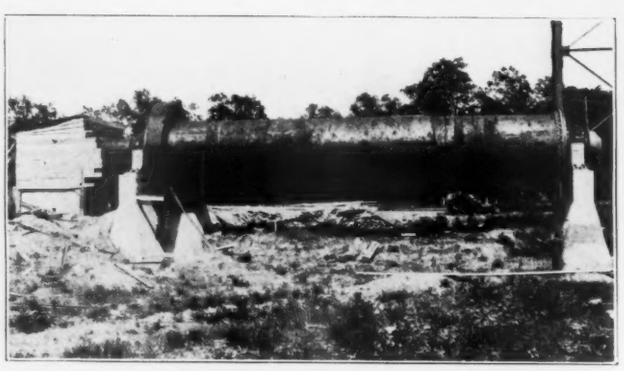
The cars will be hauled from the quarry on a wooden trestle and dumped into a hopper from which a Kennedy-Van Saun 42-in. heavy-duty pan feeder discharges to a Kennedy-Van Saun 36-in. by 48-in. double slugger roll. This discharges to a 30-in. belt conveyor, which is on 601-ft. 6-in. centers and has a slight slope. It feeds a second 30-in. belt conveyor on 717-ft. centers to the secondary-crusher house. Each conveyor is driven by a 30-hp. Westinghouse motor through a Westinghouse-Nuttall speed reducer.

Conveyor No. 2 discharges directly to a Kennedy-Van Saun 54-in. by 48-in. swing-hammer mill. This reduces the rock to ½-in. size and under, and discharges on a 40-in. inclined belt conveyor, on 170-ft. centers, to the 600-ton-capacity steel storage bin. A flop-gate at the end of this conveyor allows the rock to be diverted through a chute into the open storage alongside the plant where it will be rehandled by an overhead electric crane. An elevator will carry the rock back into the bin from the open storage.



Gasoline locomotive beside kiln.

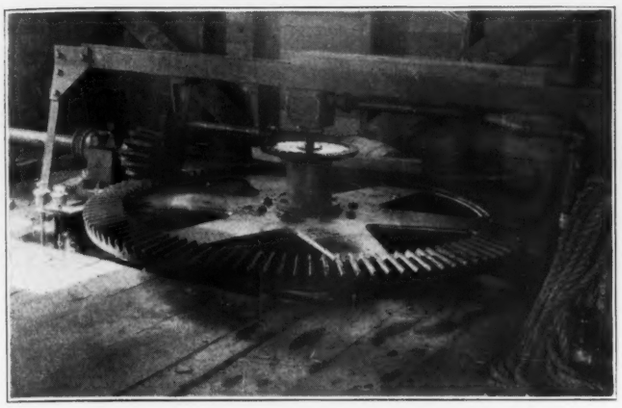
Kiln with crane runway.



Tube mill with temporary housing over motor drive.

The two long conveyors were furnished by the Robins Conveying Belt Co., and the third conveyor by the Kennedy-Van Saun Mfg. & Eng. Co. New York Belting & Packing Co. conveyor belting is used throughout. The primary crusher is belt-

driven by a 75-hp. Westinghouse motor, and the feeder by a 40-hp. motor of the same make. The secondary crusher is driven by a direct-connected 250-hp. motor, and conveyor No. 3 by a 60-hp.



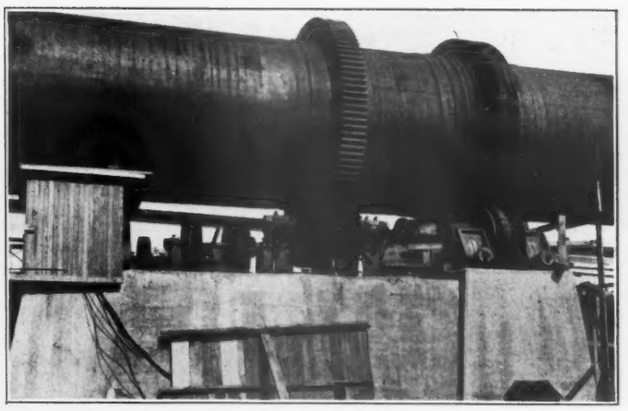
Clay tank agitator drive.

motor through a Westinghouse-Nuttall speed reducer.

The clay pit is located near the rock quarry. A shovel will load into cars which will be hauled by a locomotive to a trestle and dumped into a 20-ft. concrete wash-mill fitted with a mechanical agitator. Two 4-in. Wilfley pumps will transfer the clay

Locomotive and cars.

slip to a steel clay-storage tank, 28 ft. in diameter by 36 ft. high. This is equipped with a Manitowoc Minogue mechanical and air agitator. Two more Wilfley 4-in. pumps will transfer the slip to a steel clay-trough under the rock-storage bin. This is 15 ft. long and 36 in. deep with a semi-circular sec-



Close-up of kiln gear-drive.

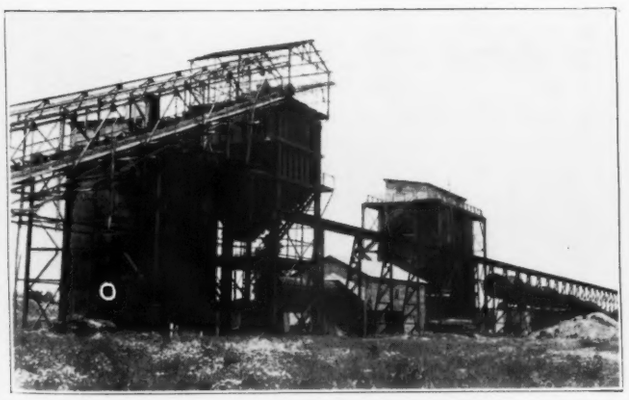
tion and will be equipped with a screw-conveyor agitator. Clay from this trough will be fed to the raw-grinding tube-mill through a regulating valve.

The rock from the steel storage bin will be fed by a Kennedy-Van Saun 36-in. table feeder through a pipe into the tube-mill, together with the clay slip. The Kennedy-Van Saun 7-ft. by 50-ft. 4-compartment tube-mill is direct gear-driven by a 1,000-hp. Westinghouse super-synchronous motor. A 7½-kw. motor-generator set excites the field in this motor.

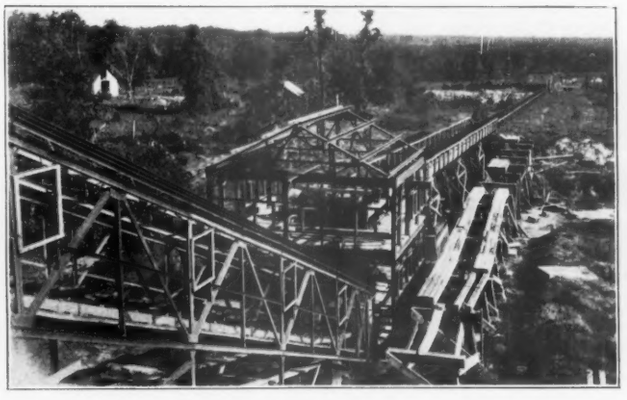
The raw tube-mill will discharge to a concrete slurry sump, 11 ft. long by 2 ft. wide and 6 ft. deep, which also will be equipped with a screw-conveyor agitator. Two 4-in. Wilfley pumps will feed the slurry to two steel slurry-storage tanks 22 ft. in diameter by 60 ft. in height. Each tank has a Manitowoc Minogue agitator, both agitators being driven from the same motor.

Two 4-in. Wilfley pumps will pump to two concrete correcting basins with circular ends, 50 ft. long by 25 ft. wide by 14 ft. deep, now under construction. Each will be equipped with Manitowoc dual mechanical and air agitation, and its own drive. Two 4-in. Wilfley pumps will feed the slurry to a Ferris-wheel feeder to the kiln.

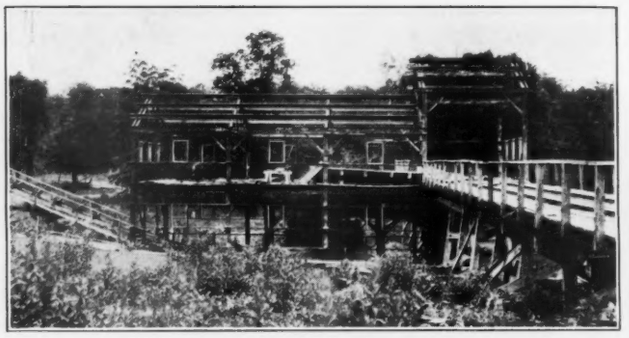
The 11-ft. 3-in. by 300-ft. Kennedy-Van Saun rotary kiln is probably the first of this type ever built in this country. It was shipped in sections



No. 3 conveyor, clay tanks, rock bin, tube mill, slurry tanks, kiln, and craneway.



Looking down from atop the clay tanks toward plant's limestone quarry.



Primary crusher house.

General view from south.

and electric-welded on the job. There are no rivets in its entire construction. The kiln has four tires of the floating type and is gear-driven by a 100-hp. Westinghouse variable-speed, slip-ring induction motor which gives it a speed varying from ½ to 1 r.p.m. It has not yet been decided what type of fuel will be used but the layout is such that coal, gas or fuel-oil may be used. Draft will be furnished by a Kennedy-Van Saun 16-ft. Cyclone with a 100-in. centrifugal fan and a 4-ft. steel stack 20 ft. high.

The kiln will discharge to a concrete-and-brick vertical cooler 20 ft. high. Sloping shelves inside will each have sprays of water playing on the clinker as it works its way to the bottom. The steam generated here will be used to dry the coal if this type of fuel should be used. The cooler will discharge to an F. L. Smidth 28-ft. Skipulter conveyor feeding an inclined chain-bucket elevator to the open clinker storage. This elevator will be equipped with an automatic scale to record production.

The open storage for rock and clinker is 780 ft. long with a span of 80 ft. It extends roughly from the rock-storage bin to the discharge end of the kiln. A 10-ton overhead crane with a 3-cu.yd. Owen clamshell bucket will rehandle the rock and clinker.

Glenn G. Allen, sec.-treas.; C. M. Loveland, chief engineer and supt.; Chas. E. Oxford, Jr., vice-president, in charge of sales.

The crane will rehandle the clinker to a bin over the finish-grinding tube-mill. This is another 7-ft. by 50-ft. Kennedy-Van Saun 4-compartment tube-mill driven by a 1,000-hp. Westinghouse motor. Gypsum will be shipped in and stored in a steel bin above the mill. Two table feeders, 36-in. for clinker and 18-in. for gypsum, will feed these materials to the mill in the desired proportions.

No. 2 conveyor (above), secondary crusher, and No. 3 conveyor (below).

A 6-in. Fuller-Kinyon pump will carry the finished cement to 12 concrete silos with a total capacity of 100,000 bbl. Each silo will be 28 ft. in diameter by 80 ft. high. Other Fuller-Kinyon pumps will carry the cement to the packhouse where it will be sacked by three Bates packers.

Duplicate units are used wherever possible to minimize the number of spare parts that must be stocked to prevent loss of production in case of a breakdown. The main operations are so designed that there is sufficient storage capacity between them to prevent loss of production from an ordinary mishap.

As explained, the layout is such that a complete second unit to double the capacity of the plant can be installed without interference to production. The crushers and conveyors have ample capacity to handle any enlargement. It would be necessary to install only an additional rock-storage bin, clay

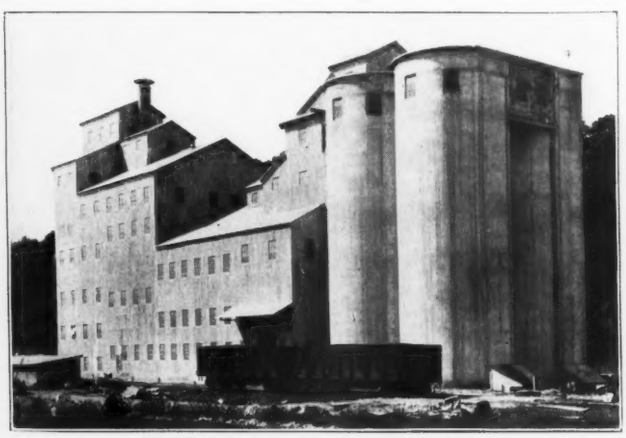
(*Continued on Page 54*)

Cement Plant's Capacity Can Be Trebled Without Stopping Operation

Present Facilities Produce 1,000 Barrels of Masonry Cement Daily

THE NEWEST and perhaps the largest and most modern masonry-cement plant in the United States was put into operation in the autumn of 1929 at Rosendale, N. Y., by the Century Cement Corp. It is located on a property of about 300 acres containing high-grade deposits which have been worked on a smaller scale for many years. One of the first natural-cement plants in the United States was located here and the kilns of a succeeding plant are being used in the present operations.

The plant was designed by and erected under the supervision of Soule & Zepp, consulting engineers, Baltimore, Md. It has a present capacity of 1,000 bbl. per day but was so designed that the necessary equipment for raising the capacity to 3,000 bbl. per day can be installed without interference



Silos and plant, viewed from east.

with operations. The entire operation was carefully planned to insure a uniform high-quality product and to require the least possible amount of labor. H. E. Brookby, of Chicago, Ill., was consulting engineer on process. The four cement-storage silos, footings and machinery foundations were erected by the Burrell Engineering & Construction Co., Chicago, Ill. The structural steel work was handled by the Pittsburgh Bridge & Iron Works, Pittsburgh, Pa.

The cement rock occurs in two separate beds of somewhat different composition, the lower bed being about 21 ft. thick and the upper 11 ft. thick, separated by 15 ft. of impure limestone. The upper bed is much lighter in color than the lower bed, but each is of a grade from which natural cement was made in the past. The excavation of the rock has been done by underground mining methods for many years, even in connection with the old plant. The room-and-pillar system of mining is followed. Three faces are worked in the lower ledge of the rock, the farthest workings being about 1,000 ft. from the main entrance. The slight dip of the rock and the large volume of the underground workings insure good ventilation and make possible the use of a gasoline locomotive in hauling the rock from the mine to the kilns. The rooms are of somewhat irregular outline, but they average around 35 to 40 ft. in width and the full height—21 ft.—of the thickness of the lower bed.

The upper ledge is worked above the 15 ft. of intervening rock strata. Thus the two grades of stone are mined separately and they are kept separate throughout the subsequent treatment.

The broken rock from the upper ledge is dumped, through a hopper cut in the rock that separates the two ledges, into cars on the lower level. Arrangements are being made to run the locomotive into the upper level also. When this is done, the two mines will be worked as distinct units, but following the same methods. One-man drills prepare the holes, air being furnished by a Chicago Pneumatic 13½-in. by 8-in. by 10-in. two-stage compressor which is installed in an underground room near the portal of the mine where pure air is obtainable. The compressor is direct-driven by a Westinghouse 100-hp., low-speed, synchronous motor which is provided with a motor-generator set for its exciter and an automatic starter.

After the rock is blasted it is hand-loaded into Koppel 2-cu. yd., side-dump, steel cars with V-shaped bodies. The loaded cars are hauled by a Plymouth 8-ton gasoline locomotive on tracks of 36-in. gauge to the trestle along the tops of the kilns, there being little difference between the elevations of the mine track and the trestle. Each

Mill buildings and silos, from west.

Raw materials car above kilns.

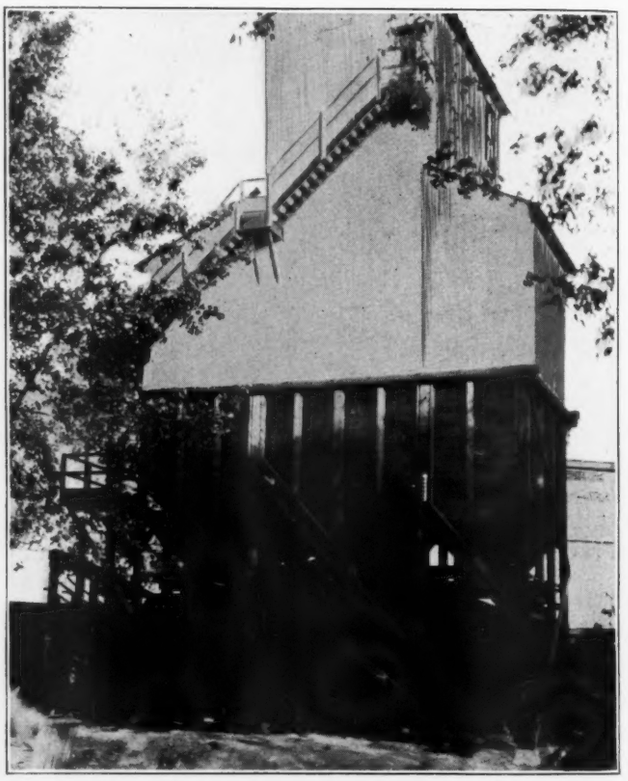
carload of rock is weighed on a track-scale as it approaches the battery of kilns.

Calcining is done in eight vertical-shaft kilns of the mixed-feed type, using buckwheat anthracite as fuel. The weight of coal used is about 6 to 7 per cent of the weight of the raw stone. The efficiency of the kilns is shown by the ratio of 10 to 1 between the cement produced and the coal burned.

The resulting clinker is drawn from the kilns and hand-picked, after which it is put through a Sturtevant crusher which reduces it to ¾-in. size. It is next taken by a 60-ft. bucket elevator and deposited in three bins. One of these bins is for the light-colored rock, another bin is for the dark rock, while the third is for possible future needs. A Stephens-Adamson 18-in. by 25-ft. apron conveyor-feeder handles the discharge from the bin gates to a hopper which loads the ten buckets of an Interstate Equipment Corp. aerial tramway which, in turn, transports the clinker a distance of about 2,300 ft., with a rise of more than 200 ft., to the top of the grinding, finishing, storage, and shipping plant.

The loading and the unloading of the tramway buckets are automatically controlled. Each tramway bucket carries about 9 cu. ft. of the calcined material, the tramway thus handling material at a rate that will furnish 90 bbl. of finished cement per hour.

The tramway discharges into any of three steel bins from which the material is fed in the desired proportions by three Schaffer Poidometers, one 30-in. and two 20-in. After other required ingredients are added, the whole is thoroughly mixed and elevated to bins over the Raymond mill.



Portion of new plant and bins.

This 5-ring low-side Raymond mill is driven through a Texrope drive by a 75-hp. General Electric motor. The pulverized material is lifted by a fan into collectors which discharge into a bin over the F. L. Smidth 5½-ft. by 20-ft. tube mill, driven by a 75-hp. General Electric super-synchronous motor. The finished product is then elevated and conveyed to the storage silos or delivered direct to the pack bin.

The four reinforced-concrete storage silos, each of which is 23½ ft. in diameter and 53 ft. high,

Old buildings (foreground), and new plant and kilns.

have a total capacity of 25,000 bbl.. Two 60-ft. screw conveyors reclaim from the silos to two 60-ft. elevators. These discharge through a Hummer vibrating screen to the steel packer bin which feeds the four-tube Bates packer. The coarse material from the screens goes back to the tube mill through a closed circuit.

All the conveyors and elevators in the new plant were furnished by Robert L. Latimer Co. and have individual motor drives through D. O. James speed reducers.

The finished product is packed in 1-cu. ft. bags bearing the Century brand. It is an improved masonry cement for brick, tile and stucco, and high-early strength is claimed. The chemical laboratory, which is equipped for all necessary physical and chemical testing, is located in an attractive office building near the mill. Ernest E. Berger, chief chemist, who is well known in the cement industry, is in charge of the laboratory and the research work in improving and developing new uses for the product.

The main offices of the company are at Rosendale, N. Y., with sales offices in New York, Philadelphia, Boston and Cleveland. The officers of the company are: Arthur E. Friedman, president; John A. Kling, chairman of the board; Stewart F. Burton and John B. Morton, vice-presidents; and Edgar A. Hahn, secretary. George W. Williams is plant superintendent.

Tractors and Trailers Solve Problem of Intraplant Transportation

One of the most vital problems in any mining enterprise is that of intraplant transportation and no matter what method or equipment is employed there is always something of interest to be studied and profitable ideas to be obtained, from a consideration of the various installations which are met with in the pit and quarry industries.

The Centropolis Crusher Co., of Kansas City, Mo., has apparently solved its problems of transportation in an effective manner by the use of Caterpillar "30" Hillside tractors and Athey side-dump trailers, which are employed to convey material from the mine to the crushers.

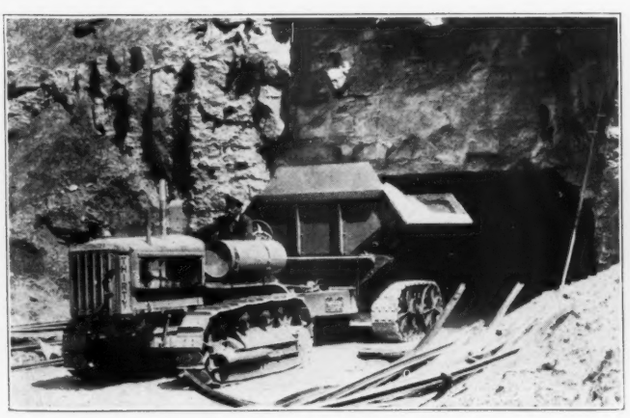
Dumping trailer into gyratory crusher.

The openings are situated at a distance of about 300 ft. from the No. 8 Allis-Chalmers gyratory crusher, so that the haul is comparatively short, the workings are level, and no difficulty is experienced in placing the side-dump trailer in the loading position. After the rock is drilled and blasted a Marion electric shovel loads each trailer with approximately 6 tons of limestone, which is then pulled to the underground crusher and dumped as shown in the illustration.

An outstanding feature of this operation is the fact that shifts are arranged to assure operation for a 24-hr. day, resulting in the removal of 264 loads or 1,584 tons daily, according to figures furnished by the Centropolis company. It would undoubtedly be possible to increase this average considerably were it not for the fact that it is necessary to move the electric loading shovel frequently from one location to another.

In addition to the No. 8 crusher there is also a No. 4 Telsmith secondary crusher. With the two Athey trailers and Caterpillar tractors it is possible to keep the crushers busy, even though it is necessary to employ them, from time to time, in piling rock dust, which is stored for future use.

The use of the electric shovel and the tractor-drawn trailers has resulted in an appreciable saving over the former method of loading small cars by hand and production has been considerably increased.



Tractor and trailer emerging from mine tunnel.

Loading trailer in tunnel with electric shovel.

New Cement Plant Near Completion

(*Continued from page 50*)

tank, slurry tanks, kiln, mills and cooler. Foundations for the second unit are already in. The same conveyor feeding the present rock-storage would discharge to a feeder to the second bin. The second of each pair of Wilfley pumps, which are now used as spares, would be used for the second unit. While the present nominal capacity is regarded as 2,000 bbl. per day, the officers of the company feel that this will be increased to 2,500 bbl. per day and that, after the proposed enlargement, the plant's capacity will actually be 5,000 bbl. per day. This objective capacity would not, however, be attempted if it were to lower the quality of the product, for, in the words of Mr. Oxford, chairman of the board, "Our object, first, last, and all the time, will be to make better cement, and we will not sacrifice quality for quantity."

The major part of the equipment was furnished by the Kennedy-Van Saun Mfg. & Eng. Corp. This company furnished the electric-welded kiln and tube-mills, the primary and secondary crushers, pan feeder, No. 3 belt conveyor and plate feeders. The Nos. 1 and 2 belt conveyors were furnished by the Robins Conveying Belt Co. The Arkansas Foundry Co. furnished and erected all the structural-steel work and the steel storage tanks and bins. Irving Iron Works steel subway gratings and stairs are used throughout. Harbison-Walker firebrick and kiln lining are used. All concrete work is being done by the company's forces.

Power is furnished at 66,000 v. by the Southwestern Gas & Electric Co. A substation at the plant reduces this to 2,300 v. for the crusher, kiln and mill motors and to 440 v. for all others. A Diesel-driven, auxiliary power plant will be installed later.

The company has on hand a 9-ft. by 90-ft. Kennedy-Van Saun rotary lime-kiln which will be part of a plant to be erected later for the production of hydrated lime.

The officers of the company are: C. E. Oxford, chairman of the board; C. Floyd Huff, president; R. R. Harkness and C. E. Oxford, Jr., vice-presidents; and Glenn G. Allen, secretary-treasurer. C. E. Oxford, Jr., is vice-president in charge of sales and his office is in Little Rock, Ark. The New York office is at 245 W. 51st St.

High-Alumina Refractories Replacing Plain Fire-Brick in Industry

Evolution in the industrial processes has been progressing more and more rapidly in each succeeding decade. The trend in the important basic industries is definitely toward concentration of output in fewer plants. Efficiency of plant practice has greatly increased and the quality of product generally has improved to meet more rigid requirements.

This development in most cases has brought about more severe operating conditions in the various types of furnaces employed. The limit to which the furnace can be driven with economy is determined only by what the refractory lining can endure. In many parts of furnaces, where the requirements are severe, high-alumina refractories have supplanted fire-clay brick, silica brick and even some of the more costly refractories, to decided advantage. The higher refractoriness of high-alumina brick permits a greater degree of insulation than is practicable with fire-clay refractories.

The alumina-silica system is interesting in any consideration of alumina refractories. While the chemical composition may indicate approximately the ultimate fusion point, it does not reveal the mineral constitution, upon which depend many desirable qualities, nor serve as a definite guide to all of the physical properties of a brick. The properties of mechanical strength at high temperatures, shrinkage or expansion under heat, slag resistance, porosity and permeability are dependent upon such factors as method and temperature of calcination of the constituents, bonding materials, process of manufacture, texture or fineness of grind, and the firing temperature.

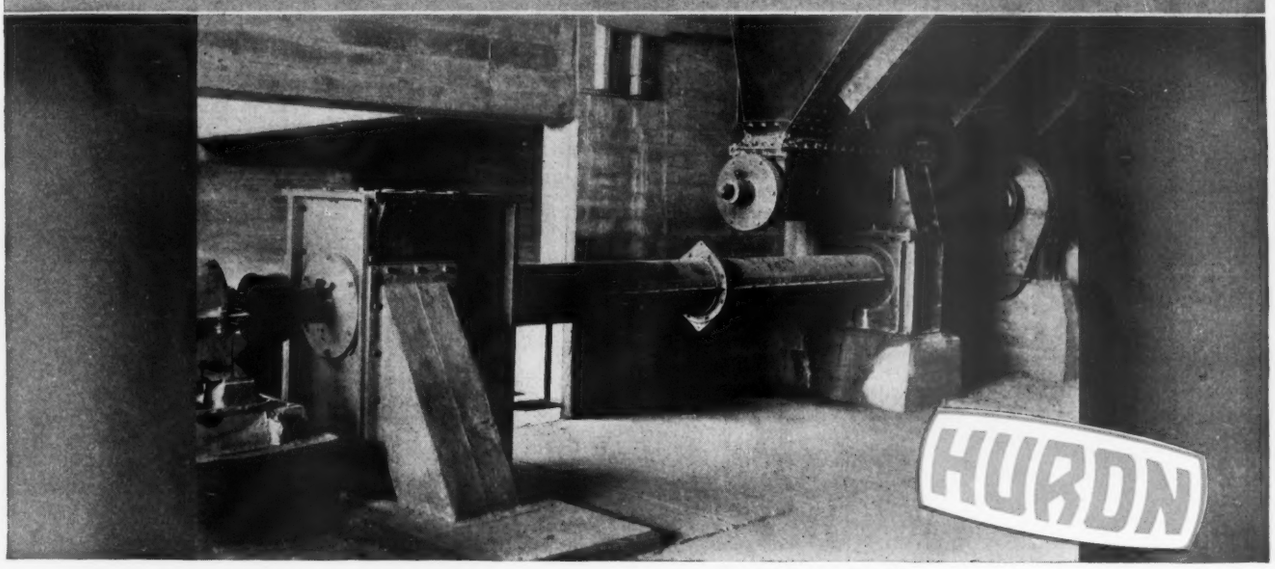
Working Heights for Shovels Depend Upon Local Conditions

If it can possibly be arranged, the maximum depth of face or cutting height when using power shovels should not be greater than the digging height of the bucket teeth; a greater depth than this can be dealt with but, should the height exceed 2 ft. to 3 ft. more than the maximum digging height of the bucket, hand labor should be used to bar or break the material down, or it can be blown down. Otherwise, heavy falls may possibly occur through undercutting the material, such falls being likely to cause damage to the machine or injuries to the men working around it. Should it be necessary to work the machine in a deeper face than is advisable, crawler traveling gear should be fitted to the machine to enable it to be readily withdrawn from the face at night or at any sign of slips or falls during the day.

Fuller's Earth Sales in 1929 Drop 10 Per Cent Below 1928

The fuller's earth sold or used by producers in the United States in 1929 amounted to 315,983 short tons, valued at $4,309,723, it is announced by the United States Bureau of Mines, Department of Commerce, which has collected statistics in cooperation with the geological surveys of Florida, Georgia, Illinois, and Texas. This is an increase of 10 per cent in quantity and value compared with 1928. Every producing state, except Nevada, showed an increase in sales, and one state that reported for 1928—Arizona—reported none for 1929. The output was reported by 17 operators in 7 states in 1929—Colorado, Florida, Georgia, Illinois, Massachusetts, Nevada and Texas.

A FEEDER of Entirely NEW Design

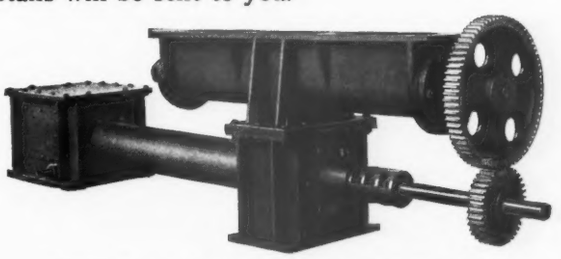


Feeds Pulverized Coal, Raw Mix and Other Fine Materials at a Uniform Rate

Delivery of a definite quantity of material at a definite rate is insured by HURON Feeders. Rate of feed can be accurately determined and regulated. Flooding is eliminated. Bridging-over is prevented.

Design and construction are the outcome of development under actual operating conditions. Simplicity makes investment and maintenance a minimum. Each feeder consists essentially of a receiving box, a feeding box, three gear-driven conveyor screws, and a discharge box. There are no fine adjustments, no parts that are subjected to excessive wear, and no complicated parts that might get out of order and be difficult to replace. In fact, all of the parts are of the kind with which operators of this class of equipment are familiar.

Made in three sizes—with 6-inch, 9-inch or 12-inch conveyor screws. Use the coupon and complete details will be sent to you.



HURON Feeders Aerate the Material and Deliver It to the Burner or Kiln at a Uniform Density and Rate

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Hold Regional Cement Safety Meetings at Cleveland and Washington

THE Portland Cement Association held two regional safety meetings last month, one at Cleveland, O., on June 24 in Hotel Cleveland, and the second on June 26 at Washington, D. C., in the Raleigh Hotel.

The program for the Cleveland meeting included a morning session with W. L. White, Jr., general superintendent of the Medusa Portland Cement Co., of Cleveland, O., in the chair. The address of welcome was given by J. B. John, chairman, Committee on Accident Prevention, of the association, and a report of safety work in the cement industry in 1929 by the secretary of the committee, A. J. R. Curtis.

Judge L. E. Skeel, president of the Cleveland Safety Council, spoke on "Safety, an Individual Responsiblity," and Dr. N. C. Yarian, representing the Cleveland Academy of Medicine, spoke on a very interesting subject, "The Relationship of the Sub-Normal Physical Risk to Industry."

After these two papers a discussion followed until adjournment of the morning session.

The luncheon, set for high noon, had E. J. Maguire, vice-president and treasurer of the Medusa company, as presiding officer and at this function, Thomas P. Kearns, superintendent of the Ohio Industrial Commission, spoke, taking for his subject, "Safety is Good Business."

The afternoon session was called to order at 1:30 p. m. by Wesley Davy, of the Lehigh Portland Cement Co., as chairman.

Two addresses followed, the first, by K. L. Marshall, of the U. S. Bureau of Mines, and the second, by W. O. Dunn, of the E. I. du Pont de Nemours & Co., followed by two motion pictures, one depicting the manufacture, shipping and testing of explosives and the second dealing with the use of dynamite in quarry works. Both of these visual lectures were by courtesy of the du Pont company.

The final item on the program was a demonstration of first aid by the team of the Ohio Public Service Co., by courtesy of E. R. Trevorton, publicity director.

The Washington meeting of the Association convened at 10:30 a. m. on June 26 for the morning session under the leadership of John J. Porter, vice-president and general manager of the North American Cement Corp. as general chairman.

A. J. R. Curtis again read his report on the safety work of the Association for 1929, followed by G. F. Martinez, superintendent of the Lone Star Cement Co., Norfolk, Va., who spoke on "Winning a Safety Trophy."

"Good Housekeeping as an Aid to Safety" was presented by P. J. Glennon, also of the Lone Star and C. S. Aldinger of the Medusa closed the morning session with the subject "What Part Does Good Housekeeping Have in Reducing Accidents?" a complementary paper to that of Mr. Adlinger.

The luncheon speaker was the Hon. James J. Davis, Secretary of Labor of the United States. Major H. A. Reninger of the Lehigh Portland Cement Co. presided.

The afternoon session was presided over by A. R. Conchman, safety director, North American Cement Corp. Six 5-minute papers were read and succeeded by round table discussions.

Finally, at 6:30 p. m., the safety dinner took place, at which Dwight Morgan, vice president of the Lone Star Cement Co., Norfolk, Va., presided as toastmaster, the after-dinner speaker being Strickland Gillilan of Washington.

Arkansas' Only Producing Plant

(*Continued from Page* 46)

with a capacity of 20,000 gal., is used for drinking water and the other, with a capacity of 100,000 gal., for process water. Both tanks were furnished and erected by the Pittsburgh-Des Moines Steel Co.

The two systems are separate but the pumps are so connected that, if necessary, either pump can be used for either line. The process line is also used for fire protection. The cooling water from various operations at the plant can be recirculated. There are also several small auxiliary pumps for use in emergencies.

There is a very modern sanitary and storm drain system for the plant and village. The sewers drain to a concrete septic tank near the north end of the plant. During the summer months the surrounding country is kept free from breeding ponds for malaria mosquitoes. The success of this method of prevention is evident from the fact that no plant employee has contracted malaria.

The Arkansas Portland Cement Co. is a subsidiary of the Ideal Cement Co., of Denver, Colo., which operates nine other plants in the West. The Arkansas plant is the easternmost of these plants. The main office is at the plant and the sales office in the Wallace Bldg., Little Rock, Ark.

The officers and personnel of the Arkansas Portland Cement Co. are: Charles Boettcher (president), C. K. Boettcher (vice-president), and R. J. Morse (vice-president and general manager), all of Denver, Colorado; C. D. Nichols (vice-president), P. A. Thompson (secretary), and M. O. Mathews (treasurer, general manager and purchasing agent), all of Oklahoma City, Okla.; D. M. Pinkston (sales manager) Little Rock, Ark.; O. A. Bayless (chief chemist) Ada, Okla.; Paul C. Van Zandt (chief engineer), J. F. Kaufman (superintendent), and Frank K. Hensley (chief plant chemist), all of Okay, Ark.

ADVERTISING PAGES OMITTED

Hawley-Smoot Tariff Bill Aids Producers of Non-Metallic Minerals

Duty on Imported Portland Cement Is Finally Set at 6 Cents per 100 Pounds

THE Hawley-Smoot tariff bill, which was passed two weeks ago by Congress after months of argument and delay, is divided into various "schedules." "Schedule 2—Earths, Earthenware, and Glassware," is of special interest to operators and workers in the non-metallic industries.

It is to be noted that this schedule provides for a 6-cent duty per bag on Portland cement and, while this does not appear to be adequate protection on imported cement, it is quite certain that, along the eastern seaboard, some advantage to American manufacturers will obtain. At a relative distance of 200 miles from the coast cement manufacturers are indifferent to any question of restrictive tariff as freight rates protect them sufficiently from foreign competition.

The following paragraphs are quoted from the new law as those affecting the non-metallic mineral industries:

Par. 203. Limestone (not suitable for use as monumental or building stone), crude, or crushed but not pulverized, 5 cents per one hundred pounds; lime, not specially provided for, 10 cents per one hundred pounds, including the weight of the container; hydrated lime, 12 cents per one hundred pounds, including the weight of the container.

Par. 204. Crude magnesite, fifteen thirty-seconds of 1 cent per pound; caustic calcined magnesite, fifteen sixteenths of 1 cent per pound; dead burned and grain magnesite, and periclase, not suitable for manufacture into oxychloride cements, twenty-three fortieths of 1 cent per pound.

Par. 205. (a) Plaster rock or gypsum ground or calcined, $1.40 per ton.

(b) Roman, Portland, and other hydraulic cement or cement clinker, 6 cents per one hundred pounds, including the weight of the container; white nonstaining Portland cement, 8 cents per one hundred pounds, including the weight of the container.

(c) Keene's cement, and other cement of which gypsum is the component material of chief value: Valued at $14 per ton or less $3.50 per ton; valued above $14 and not above $20 per ton, $5 per ton; valued above $20 and not above $40 per ton, $10 per ton; valued above $40 per ton, $14 per ton.

(d) Other cement, not specially provided for, 20 per centum ad valorem.

Par. 206. Pumice stone, unmanufactured, valued at $15 or less per ton, one-tenth of 1 cent per pound; valued at more than $15 per ton, one-fourth of 1 cent per pound; wholly or partly manufactured, three-fourths of 1 cent per pound; manufactures of pumice stone, or of which pumice stone is the component material of chief value, not specially provided for, 35 per centum ad valorem.

Par. 207. Clays or earths, unwrought and unmanufactured, including common blue clay and Gross-Almerode glass pot clay, not specially provided for, $1 per ton; wrought and manufactured, not specially provided for, $2 per ton; bentonite, unwrought and unmanufactured, $1.50 per ton, wrought and manufactured, $3.25 per ton; china clay or kaolin, $2.50 per ton; crude feldspar, $1 per ton; bauxite, crude, not refined or otherwise advanced in condition in any manner, $1 per ton; fuller's earth, unwrought and unmanufactured, $1.50 per ton; wrought or manufactured, $3.25 per ton; clays or earths artificially activated with acid or other material, one-fourth of 1 cent per pound and 30 per centum ad valorem; silica, crude, not specially provided for, $3.50 per ton; fluorspar, containing more than 97 per cent of calcium fluoride, $5.60 per ton; containing not more than 97 per cent of calcium fluoride, $8.40 per ton; sand containing 95 per centum or more of silica and not more than six-tenths of 1 per centum of oxide of iron and suitable for use in the manufacture of glass, $2 per ton.

Par. 208. (a) Mica, unmanufactured, valued at not above 15 cents per pound, 4 cents per pound; valued at above 15c per pound, 4 cents per pound, and 25 per centum ad valorem.

(b) Mica, cut or stamped to dimensions, shape, or form, 40 per centum ad valorem.

(c) Mica films and splittings cut or stamped to dimensions: Not above twelve ten-thousandths of an inch in thickness, 25 per centum ad valorem; over twelve ten-thousandths of an inch in thickness, 40 per centum ad valorem.

(d) Mica films and splittings cut or stamped to dimensions, 45 per centum ad valorem.

(e) Mica plates and built-up mica, and all manufactures of mica, or of which mica is the component material of chief value, by whatever name known, and to whatever use applied, and whether or not named, described, or provided for in any other paragraph of this Act, 40 per centum ad valorem.

(f) Untrimmed phlogopite mica from which no rectangular pieces not exceeding two inches in length or one inch in width may be cut, 15 per centum ad valorem.

(g) Mica waste and scrap, valued at not more than 5 cents per pound, 25 per centum ad valorem; mica waste and scrap valued at more than 5 cents per pound, shall be classified as mica, unmanufactured.

(*Continued on Page 71*)

Straight-Line Operation Feature of New Indiana Sand-and-Gravel Plant

Efficient Design of Plant Eliminates Recrushing or Rehandling of Material

By W. E. TRAUFFER

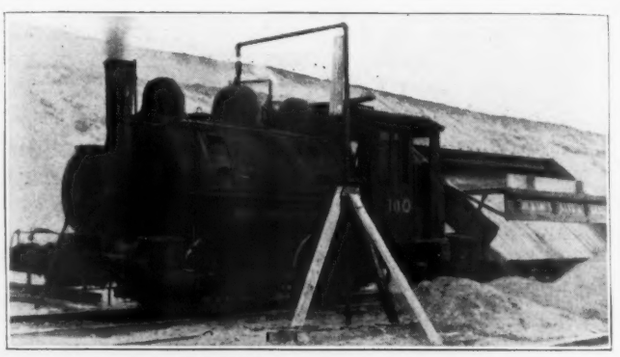
THE Dickason Sand & Gravel Co., of Cayuga, Ind., last summer put into operation a new sand-and-gravel plant possessing several interesting features. It is a straight-line operation, with no rehandling or recrushing of material. The unusually high, narrow storage bins allow sand to be loaded through side gates into cars without the use of additional water.

The plant has concrete foundations throughout, with timber superstructure, and has a capacity of 2,500 tons per 10-hour day. It was designed by the Stephens-Adamson Mfg. Co., which also furnished most of the equipment and superintended the construction and installations. Tom Ruddy was in charge of construction for this company, while John G. Black superintended the operation for the gravel company. Ground was broken for this plant on April 15, 1929 and operation was begun on July 15, this in spite of eleven days lost on account of rain and the fact that the siding and switch tracks to the adjoining railroad required a 24-ft. fill over 1,000 ft. long. The plant operated at capacity until Nov. 18 last year, when it was shut down for the winter. On April 16 of this year it again went into operation.

The property of about 320 acres on which the plant is located lies between the main line of the C. and E. I. Ry. and Indiana State Highway No. 63, which run parallel at this point about 2½ miles north of Cayuga, Ind., and 15 miles southeast of Danville, Ill. The C. and E. I. Ry. opened this pit about 15 years ago, using the pit-run material for ballast. It then lay idle until the present plant was built.

The gravel averages 39.6 ft. in depth and consists of about 40 per cent gravel and 60 per cent sand. Very little of this gravel is over 4-in. in size and less than 5 per cent requires crushing. The part of the pit now being worked is about 2,000 ft. long extending north from the plant.

The overburden, which averages 6.4 ft. in thickness, is removed during the winter by a Marion 37 electric shovel. The material is loaded into cars and hauled to the edge of the quarry where it is dumped onto the ground and is re-handled to disposal by a P & H gasoline crawler crane with a ¾-cu. yd. Kiesler clamshell bucket on a 35-ft. boom.

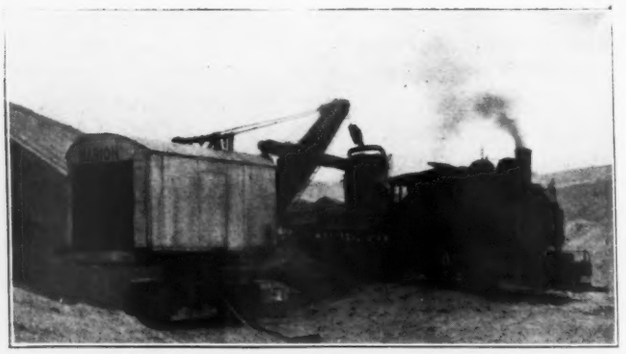


Steam locomotive with cars dumping to plant hopper.

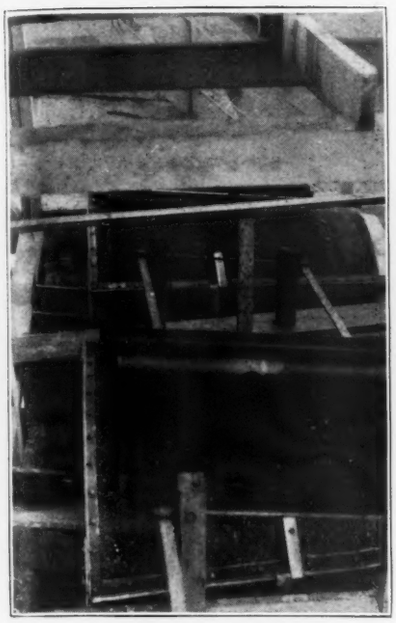
Left to right: T. A. Ruddy, designing engineer; J. G. Black, gen. supt., Brownell Improvement Co.; Ben O'Connor, plant. supt.

The same Marion 37 full-revolving electric crawler shovel with a 1¾-cu. yd. dipper loads into two trains of three 12-cu. yd. Western side-dump cars. These are hauled by two American steam locomotives of 30 and 50 tons. When the plant is operating at capacity, both trains are used to haul material to the plant, but at other times one train hauls from the plant to stockpiles, which run on the old pit floor south from the plant.

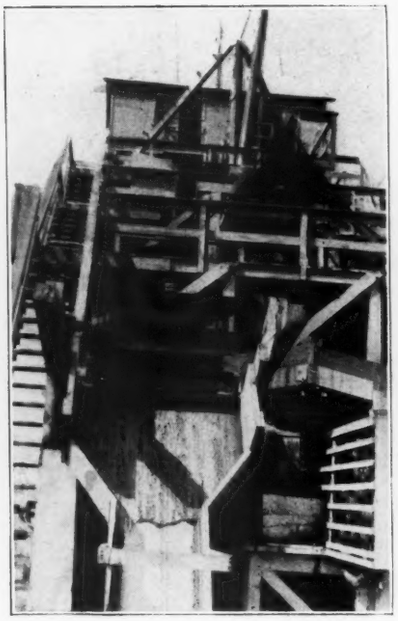
The cars discharge at the plant into a ground-level concrete track-hopper through a 5-in. rail grizzly. This discharges through a Seaverns 24-in. by 30-in. clamshell bin gate onto a 42-in. inclined belt conveyor on 30 ft. centers operating in a concrete tunnel at right angles to the line of the plant.



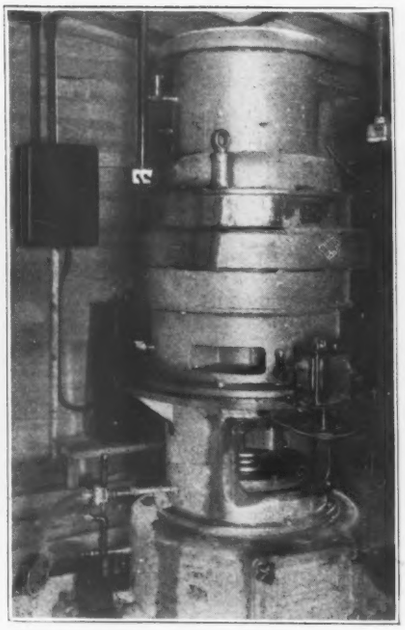
Electric shovel loading side-dump cars, and locomotive.



Two of the sizing screens, showing the rollers.



Screens and derrick above sand drag boxes.

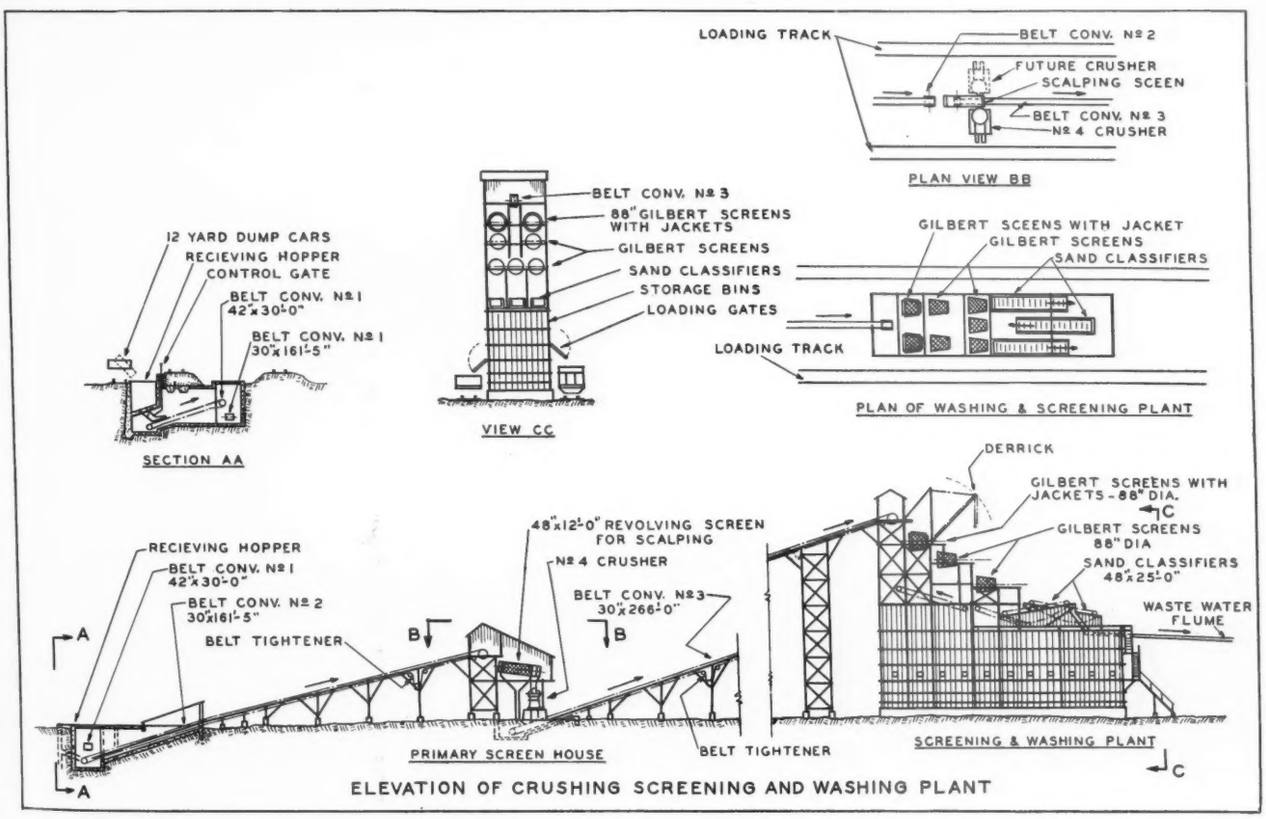


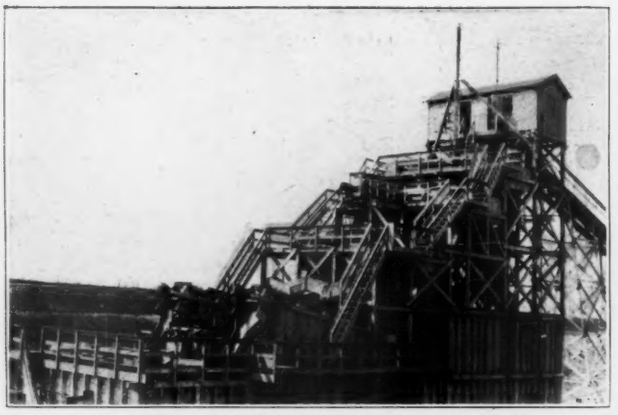
One of the pumps that furnish washing water.

This discharges through a chute onto a 30-in. inclined belt conveyor on 161-ft. 4¾-in. centers to the scalping building. A man located at the intersection of these two conveyors controls the Seaverns hopper gate by means of long levers. Both of the conveyors are gear-driven, the first by a 7½-hp. and the second by a 20-hp. motor.

The conveyor discharges into a Stephens-Adamson 48-in. by 12-ft. revolving scalping screen. All material over 2-in. goes through a chute to an Allis-Chalmers No. 4 Gates gyratory crusher which reduces to 1½-in. and under. The material from the crusher and that under 2-in. from the scalping screen goes to a 30-in. inclined belt conveyor on 266-ft. centers to the screening building. The scalping screen is belt-driven by a 15-hp. motor and the main conveyor, through double-reduction gears, by a 40-hp. motor. The crusher is belt-driven by a 25-hp. Crocker-Wheeler motor.

The main conveyor discharges through a split





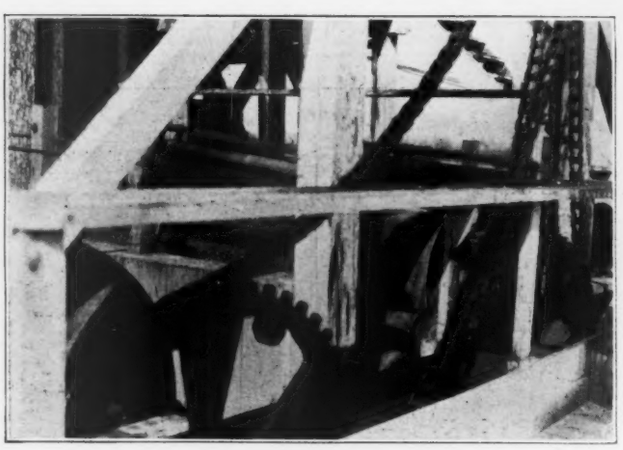
Screening plant, from southeast.

Gyratory crusher and belt conveyor to screening and washing plant.

Gyratory crusher below scalping screen.

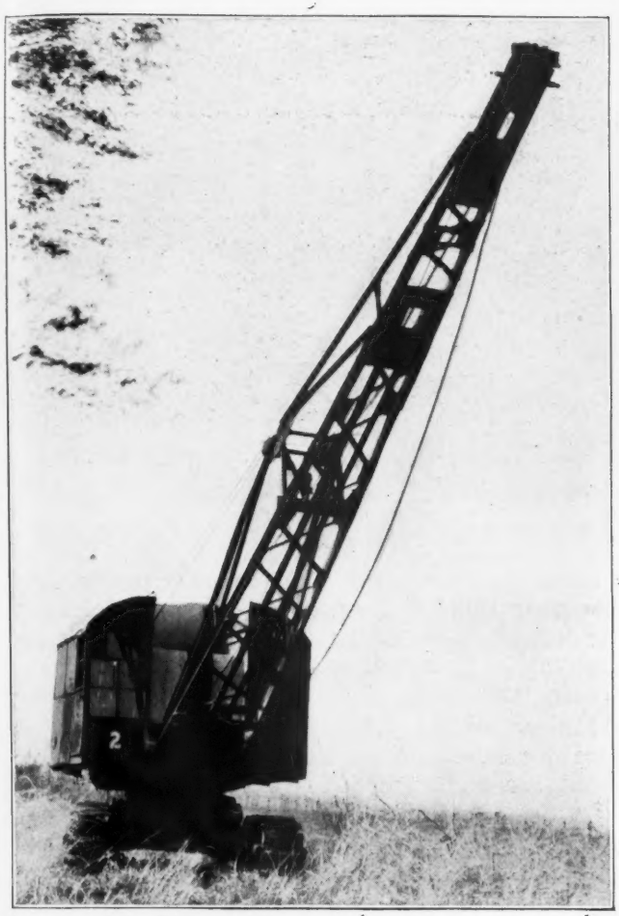
chute into two Stephens-Adamson Gilbert double-jacketed revolving screens. The inner jackets have 2-in. perforations and the outer jackets 1½-in. wire mesh. The two large sizes go direct to bins while the material under 1½-in. goes to a second pair of Gilbert screens. These have ⅝-in. wire mesh. The material over ⅝-in. drops to a bin while that under ⅝-in. goes through split chutes to a set of three Gilbert screens each with ¼-in. wire mesh.

The ¼-in. to ⅝-in. material goes to a bin while the under ¼-in. goes to three Stephens-Adamson sand-drag boxes, with 48-in. paddles on 25 ft. centers, which produce torpedo sand. The extremely fine sand, with the dirt and water, goes to a wooden flume which discharges into a worked-out section of the pit. All of the sand boxes discharge directly into bins, but one is so arranged that the material can be fed to a 3-ft. by 6-ft. single-deck Universal vibrating screen which produces plastering sand. A short 25-in. belt conveyor can take the sand from the drag boxes to the bins containing 1-in. and 2-in. gravel when a mixed product is desired. Another short 24-in. conveyor can take the ⅝-in. material to the 1½-in. gravel bin when this mixture is called for. The seven Gilbert sizing screens are all chain-driven from the same 40-hp. motor. The classifiers are each gear-driven by a 7½-hp. motor, each of the



Drive chains and rollers, fine-sizing screen.

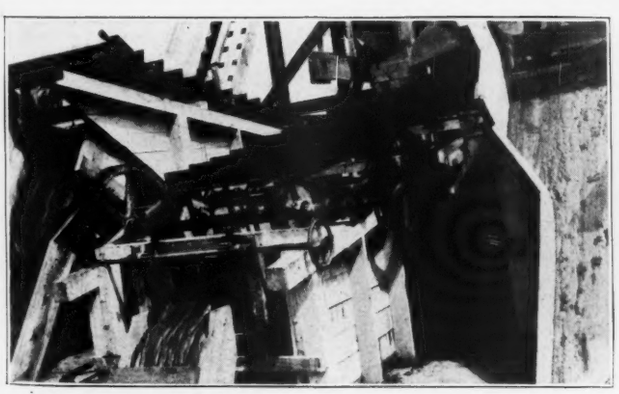
Main conveyor and crusher and scalping-screen house.



Crawler-mounted gasoline crane used for stripping.

short conveyors by a 3-hp. motor, and the vibrating screen by a 1-hp. motor.

The bins supporting the screening plant are of timber construction on concrete foundations. The six compartments have a total capacity of about 850 tons and discharge through 11 Stephens-Adamson drop-chute segmental gates on each side into cars. The gates on one side are high enough to load into gondola cars while those on the other side are high enough for hopper cars. In this way the greatest possible amount of live storage is secured. The sand is loaded without the use of additional water. This is made possible by the high and narrow sand bins. The cars are spotted under

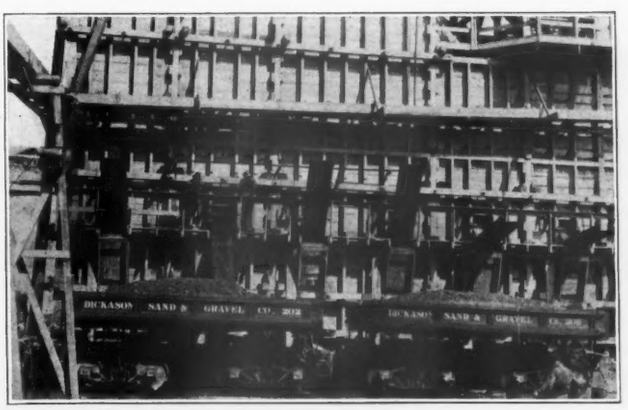


One of the sand classifiers. Note weir-gate for reducing water level.

Transfer point between short belt feeder from track hopper to belt conveyor.

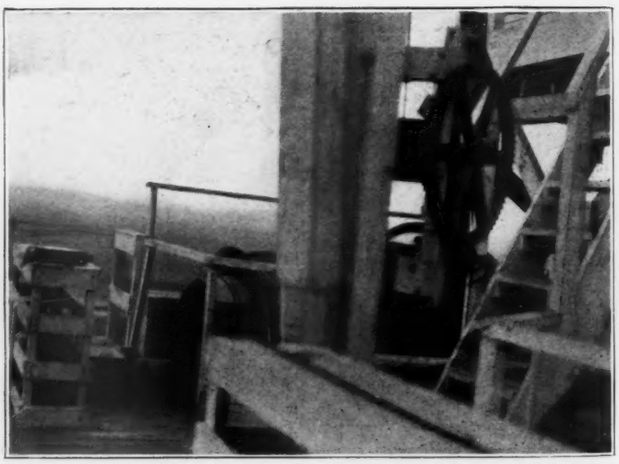
the bins by one of the locomotives, giving maximum loading speed when this is necessary.

About 1,000 ft. of track was laid last winter south of the plant to permit stockpiling of material. When desired, any size of material can be loaded into one of the trains of dump cars and dumped alongside the track, which is elevated. A Browning steam locomotive crane with a 50-ft. boom handling a 1½-cu.yd. Kiesler clamshell

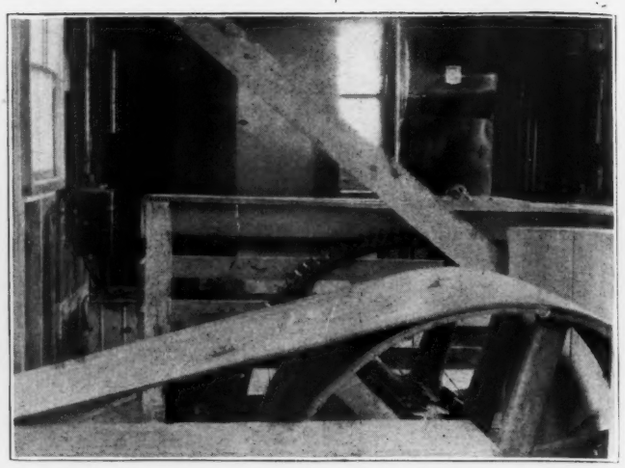


Loading cars from west side of building for stockpiling.

Showing how sand classifiers have opposite slopes.



One of the coarse sizing screens with the stiff-leg derrick in foreground.



Drive end of main conveyor, and control switches for screening building.

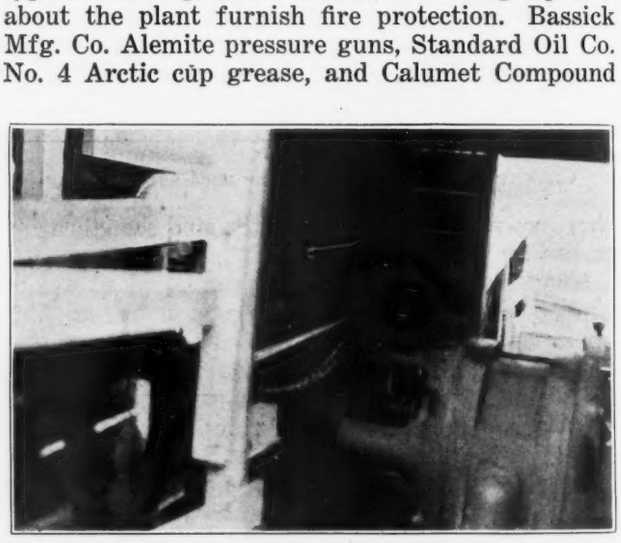
bucket rehandles the material into cars for shipment. The P & H crane can also be used for this purpose.

The wash water for the plant is furnished by two American Well Works 2,000-g.p.m.-capacity turbine pumps, one at each end of the plant. Both wells are 120 ft. deep and both pumps discharge to the same standpipe at the plant. Each pump is in a wooden frame house and is driven through a flexible coupling by a 100-hp. General Electric motor. Crane valves and fittings are used exclusively.

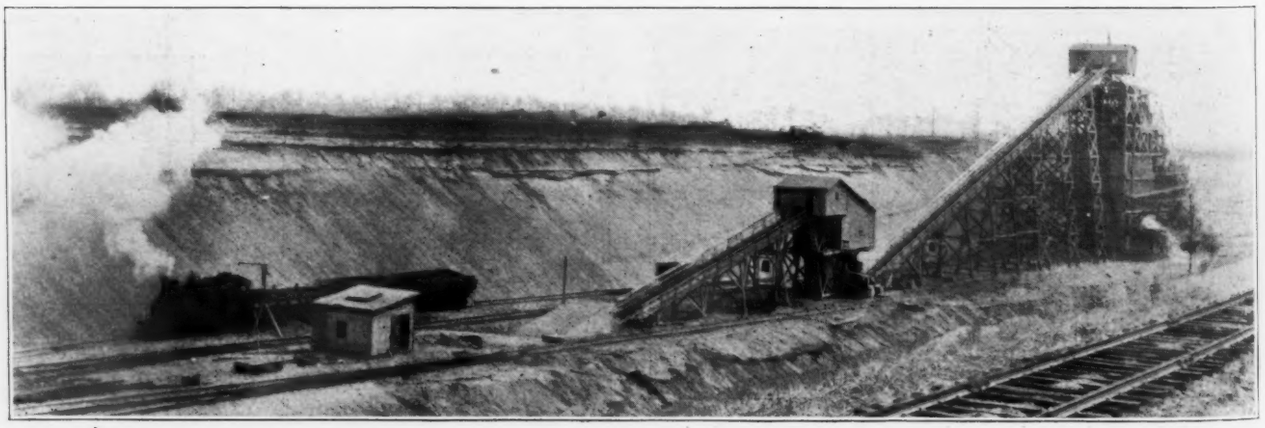
Power is purchased from the Wabash Valley Electric Co. at 2,300 volts. This is reduced to 440 volts at a small substation for all plant operations. A small transformer reduces to 110 volts for lights. With a few exceptions, all electric motors were furnished by the Allis-Chalmers Mfg. Co. Cutler-Hammer automatic starters, controllers and grids, Square D safety switches, and National Electric Products Co. Sheararduct conduit are used.

The Stephens-Adamson Mfg. Co., in addition to designing the plant, furnished most of the equipment including the Simplex conveyor idlers and pulleys, scalping and sizing screens, sand classifiers, bin gates, sprockets, pulleys, drive chains, Saco conveyor belting, chutes and the gravity take-ups for the two long inclined belt conveyors. An American Hoist & Derrick Co. hand-operated stiff-leg derrick on top of the screening plant above the first pair of sizing screens is used for handling the repair parts.

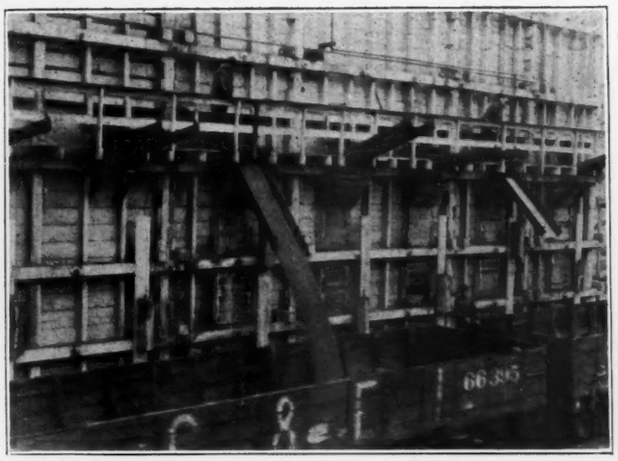
Miller-Peerless Mfg. Co. non-freezing pump-type fire extinguishers located at strategic points about the plant furnish fire protection. Bassick Mfg. Co. Alemite pressure guns, Standard Oil Co. No. 4 Arctic cup grease, and Calumet Compound



Motor drive for sizing screen.



Locomotive and cars at track hopper. Scalping and crushing building (center), and screening plant at right.



Loading railroad cars, from east side of plant, for shipment.

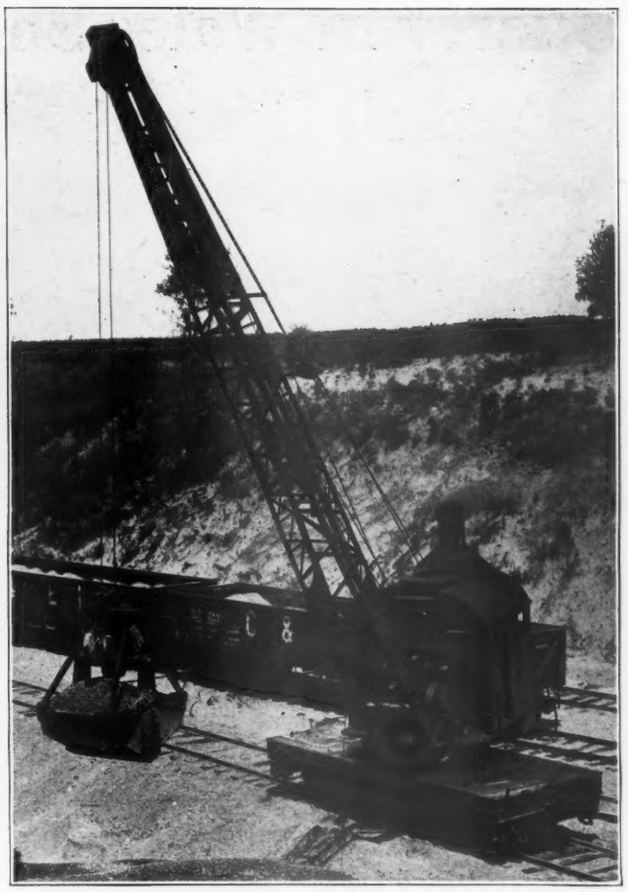
No. 8 are used for lubricating the machinery. Roebling cable is used throughout the plant.

The plant office is west of the plant in a wooden frame building which also houses the repair shop. This contains a Bastian Blessing Co. welding and cutting outfit, a Van Dorn Electric Tool Co. portable electric drill and stand, a Canedy Otto Mfg. Co. forge, and a complete set of tools including Trimo pipe wrenches.

The plant is connected by a ¾-mile switch with the C. and E. I. Ry. Connections which allow shipments to be made in any direction are with Nickel Plate at Cayuga, and the Wabash and I. T. S. at Danville. Shipments are made as far as Chicago, 140 miles north, and Evansville, Ind., 160 miles south. Nearly all of the product is used for road and concrete work.

All the stock of the Dickason Sand & Gravel Co., is owned by the Brownell Improvement Co., of Chicago, although it is operated as a separate company. Offices are in the Builders' Building, Chicago, Ill. The officers are: W. P. Hodgkins, president; E. J. Tommendall, treasurer; J. T. Abbott, purchasing agent; B. D. O'Connor, plant superintendent.

Vibrating screen which produces plastering sand.



Steam locomotive crane with clamshell bucket rehandling material to cars.

Hawley-Smoot Bill Passes

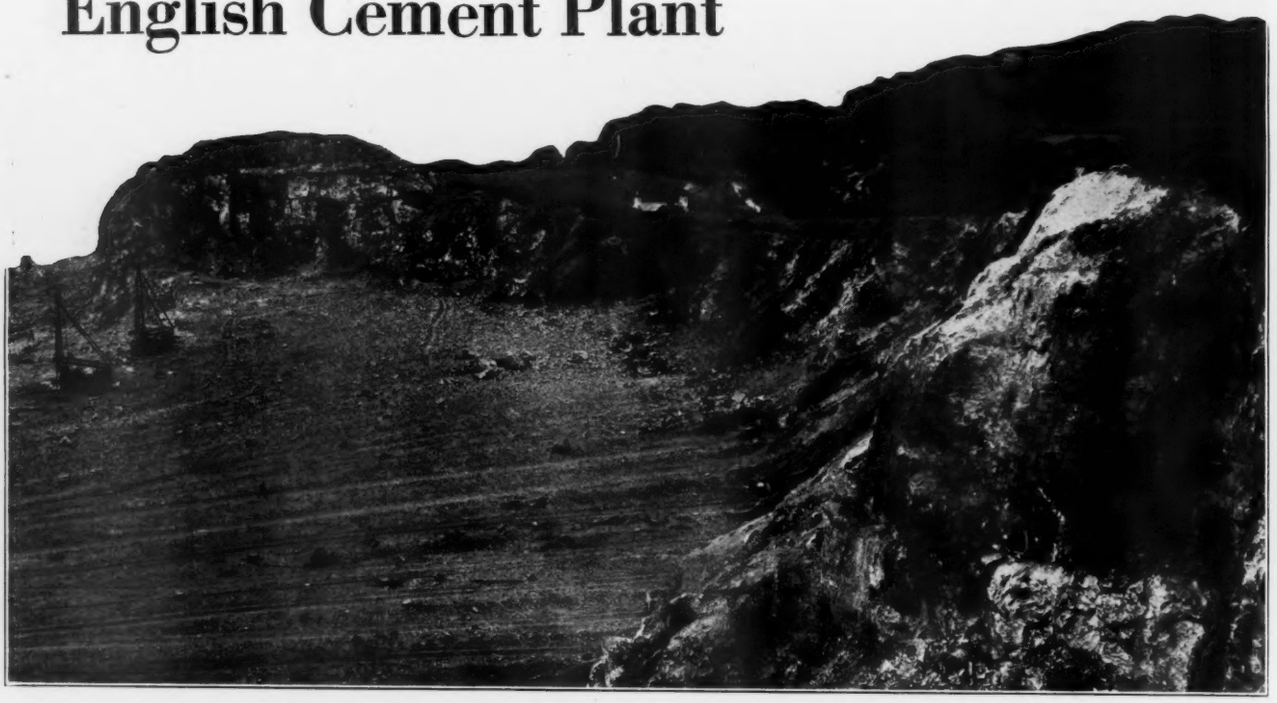
(Continued from Page 65)

(h) Mica, ground or pulverized, 20 per centum ad valorem.

Par. 209. Talc, steatite or soapstone, and French chalk, crude and unground, one-fourth of 1 cent per pound ground, washed, powdered, or pulverized (except toilet preparations), 35 per centum ad valorem; cut or sawed, or in blanks, crayons, cubes, disks, or other forms, 1 cent per pound; manufactures (except toilet preparations), of which talc, steatite or soapstone, or French chalk is the component material of chief value, wholly or partly finished, and not specially provided for, if not decorated, 35 per centum ad valorem; if decorated, 45 per centum ad valorem.

Par. 213. Graphite or plumbago, crude or refined; Amorphous, 10 per centum ad valorem; crystalline lump, chip or dust, 30 per centum ad valorem; crystalline flake, 1.65 cents per pound. As used in this paragraph, the term, "crystalline flake," means graphite or plumbago which occurs disseminated as a relatively thin flake throughout its containing rock, decomposed or not, and which may be or has been separated therefrom by ordinary crushing, pulverizing, screening, or mechanical concentration process, such flake being made up of a number of parallel laminae, which may be separated by mechanical means.

Quarry in Wales Ships Stone by Boat to English Cement Plant



Looking down upon old quarry floor, with well drills sinking for new level.

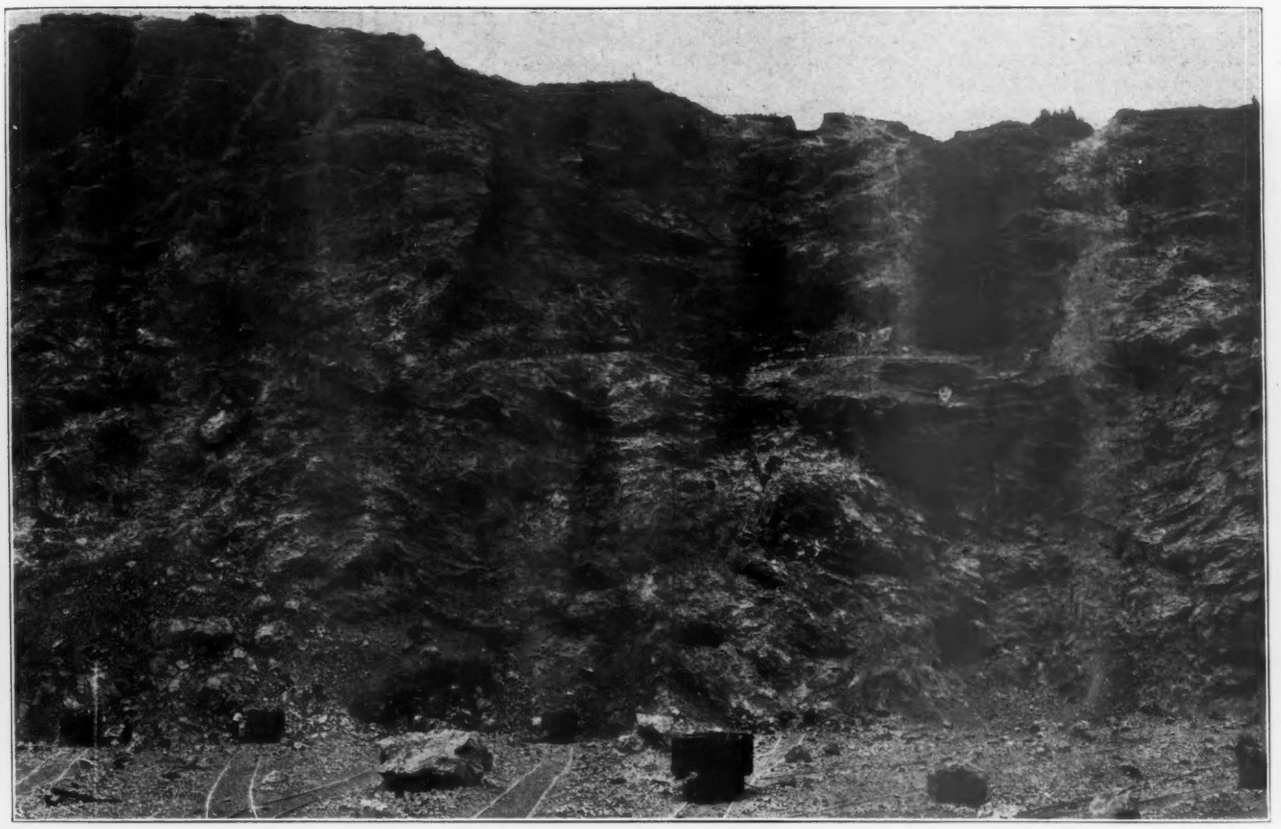
THE Allied Cement Manufacturers, Ltd.—a recent combination of a number of prominent Portland-cement makers of England—is one of the greatest producers in the British Empire, having a production capacity of approximately 7,000,000 bbl. per year. The main producing units are the Ship Canal plant at Ellesmere Port, Wirral, a 6-kiln operation; the Holborough (Kent), Harbury, and Rhee Valley plants, each operating 3 kilns; and the Dunstable and Sittingbourne plants, each operating 2 kilns. All plants are modern and are uniformly equipped with 200-ft. by 10-ft. rotary kilns. For the past two years considerable extensions and improvements have been made to modernize the plants.

Of particular interest is the new crushing plant at the Little Arme limestone quarry at Llandudno, North Wales, which supplies raw material to the 6-kiln Ship Canal cement plant at Ellesmere Port, Wirral. The crushing plant is said to be the most modern in England.

In the autumn of 1926 it became evident that the old method of hand-loading was inadequate to cope with modern production methods and a comprehensive scheme of improvement was undertaken. Steam-shovel loading was adopted and a complete new crushing plant, and drilling and blasting equipment, were installed.

Overburden is removed by means of a Caterpillar tractor and Baker-Maney model D self-loading scrapers, the tractor first loosening the top layer by drawing a scarifier, fitted with heavy tines, over the surface. Blast holes 6 in. in diameter are drilled 60 ft. to 100 ft. apart by two Key-

Hammer mills and direct-connected motors.

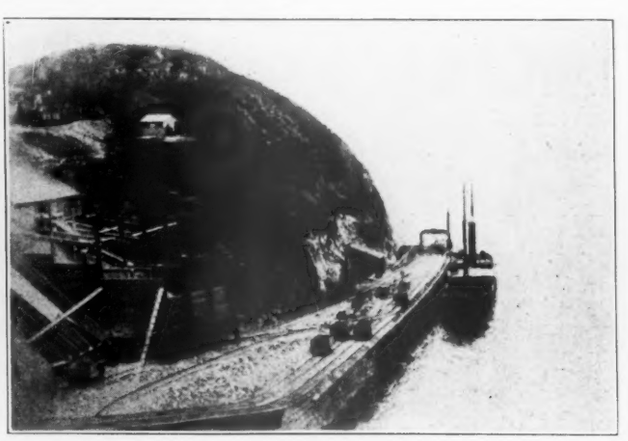


Face of quarry showing old method of loading. Note the irregular and rugged nature of the formation.

stone well drills. The holes are arranged in rows. High explosives, put up in special 6-in. cartridges, are used and Cordeau-Bickford detonating fuse is employed to set off the shots. Good fragmentation is obtained and very little secondary shooting is required. When secondary drilling is necessary, jackhammer drills are used. The rock produced is a very hard, dense limestone, of high calcium-carbonate content. Bench work with tripod drills was the method used prior to the new installation, the stone when blown down being loaded by hand into 3-ton wooden side-dumping wagons.

Three Ruston steam shovels, crawler-mounted and equipped with 2¾-cu. yd. buckets, are used to handle the stone to the Phoenix side-dumping steel quarry cars. These cars are of 7-ton capacity and have replaced the wooden wagons formerly used. The loaded cars are taken to the primary crusher by a Sentinel steam locomotive, being dumped by a pneumatic hoist. The crusher, a 20-in. Superior McCully gyratory, is driven by a 220-hp. motor. Passing through the crusher, the rock is reduced to pieces of 4-in. to 5-in. maximum size at a rate of 250 tons per hour. The material is delivered direct to a 36-in. continuous bucket elevator on 58-ft. centers, which delivers it to a 12-ft. by 60-in. scalping screen with 1¼-in. perforations. The undersize passes direct to a belt conveyor enclosed in a dust-proof casing while the oversize goes to two Pennsylvania swing-hammer mills for secondary crushing. Each hammer mill is direct driven by a 250-hp. motor, and each reduces the

View, from rim of quarry, of plant and offices.



Loading stage and bins before the modern improvements.

Superheat-steam locomotive.

rock to sizes below 1¼ in. The discharge is fed to the conveyor mentioned above which carries the "throughs" from the scalping screens. The conveyor passes through a reinforced-concrete tunnel underneath two railroad tracks to a steel tower which has been erected in line with the centers of four storage bins, which are built on the face of the cliff fronting the sea. At this point the conveyor discharges at right angles to another belt conveyor, which is carried on steel bridge work extending from end to end of the four bins and parallel to the sea front. Both conveyor belts are of the troughed - idler type, 30 in. wide, the first being 114 ft. on centers, and the second 105 ft. centers, each being provided with suitable gearing for direct motor drive.

The second conveyor is provided with a tripper for distributing the crushed stone into the four bins, which have a combined capacity of a little more than 3,000 tons.

Vessels of from 500- to 1,000-ton capacity are loaded at the wharf from the storage bins and they are easily loaded and cleared in less than an hour.

The new quarry and crushing plant were constructed and operations were so synchronized with the old plant that production was not interfered with. As the primary crusher is fed from the existing quarry level, considerable excavation was required—as deep as 35 ft. in some places. All the foundation work, including floors, crusher and motor beds, elevator pits, parapet walls and supports for the plant superstructure, are of reinforced concrete.

All the properties of the Allied Cement Manufacturers, Ltd., are under the supervision of J. T. Phelan, vice-president and production director.

Sinking holes to straighten face of quarry.

General view of offices, shops and new crusher buildings.

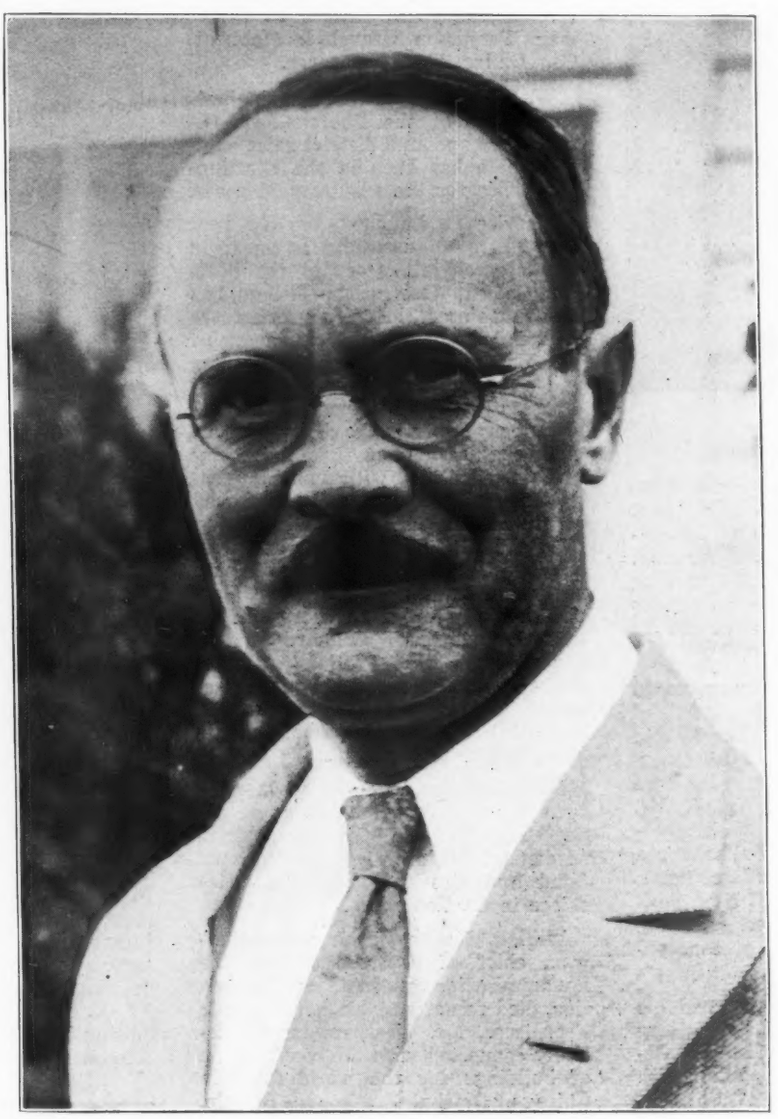
View of the stripping operations.

J. T. Phelan (left) and the late Major Sir Henry Seagrave.

New dock, bins, crusher house and steel tower.

MEN OF THE INDUSTRY

The portrait printed on this page in each number of PIT AND QUARRY is selected without significance as to current events or the position of the individual in the industry.



PAUL C. VAN ZANDT

Chief Engineer
Ideal Cement Co.
Denver, Colo.

Personal Mention

Porter W. Yett.

George Rockey has been named superintendent of the Ottawa, Ill., plant of the Moline Consumers Co. He succeeds **Carl Toline**, who died recently. Mr. Rockey had been connected with the company for 12 years as master mechanic before being advanced to his present position.

J. Catto, Jr., was recently appointed manager of the Republic Portland Cement Co., Smith-Young Tower, San Antonio, Tex., with plant at Longhorn, 10 miles northeast. He succeeds W. M. Thornton, resigned. Mr. Catto was formerly with the International Cement Corp., at Dallas, for a number of years. He was later transferred to the main office at New York as assistant sales manager, resigning after a year to take his present position.

James F. Gilbert has resigned his position as manager of the Ripley County Limestone Quarries of Osgood, Ind., to accept a position with Albert E. Pierce & Co. of Chicago. Mr. Gilbert went to Osgood in 1923 from Lawrenceburg, Ky., when the Ripy Brothers of that place purchased the stone quarry from G. W. Cox.

E. L. Saberson, who has been connected with the Masonite-Presdwood Corp., Chicago., since its inception, has been appointed assistant sales manager in charge of dealer sales. **E. B. Bushnell** has been named head of the concrete-forms department, and **J. T. Card**, who has been promoting industrial sales, has been appointed industrial sales manager.

Porter W. Yett, of Swigert, Hart & Yett, Inc., Portland, Ore., was elected president of the Association of Paris Transit-Mixed Concrete Manufacturers, which was organized April 15, 1930, at a meeting in Chicago. Other officers elected to serve for the first years are: **Charles P. Maloney**, of Maloney Paving Co., Washington, D. C., secretary; and **Bruner R. Penniman**, Penniman Gravel & Materials Co., Dallas, Tex., treasurer.

W. W. Whorley of the Birmingham, Ala., office of the Bucyrus-Erie Co. has been appointed district sales engineer. He has been in the Birmingham office for the past several years.

Maurice B. Lagaard, for the past four years an associate engineer in the research laboratory of the Portland Cement Association, Chicago, has been appointed chief engineer of the Minneapolis Bridge Co., Minneapolis. Mr. Lagaard, a native of Minnesota and a graduate of the University of Minnesota (1915), formerly was assistant professor in the department of civil engineering of that university and was identified with many investigations in concrete and reinforced concrete from 1915 to 1926. During 1918 and 1919 he was connected with the investigations of the concrete ship section of the Emergency Fleet Corporation. In order to carry on the work for which Mr. Lagaard was responsible in the Portland Cement Association, the personnel of the research laboratory is being regrouped and **T. C. Powers**, of Salem, Ore., is being added to the staff.

D. D. McGuire, formerly engineer of tests for the Tennessee highway department, has accepted the position of district engineer for the National Sand and Gravel Association, with offices in St. Louis, Mo.

William Henry Harrison Weatherwax, chief of construction for the Panama-Pacific International Exposition, died recently at his home in San Francisco. Mr. Weatherwax was actively connected with the construction of buildings for the world fairs in Chicago, Omaha, St. Louis, Buffalo, Norfolk, Va., and Philadelphia. He was 73 years old.

A. V. Griffin has been appointed general manager of the Morris Limestone Products Co., Inc., Morris, Ill., succeeding **Paul Schroter**, who was manager and founded the company in 1928. The appointment was made unanimous at a meeting of the stockholders. Mr. Griffin has been in the employ of the company only a short time and was formerly cashier of the First Trust & Savings Bank of Morris.

Bruner R. Penniman.

W. L. Lewis, formerly assistant comptroller of the Bethlehem Steel Corp., has been elected vice-president, secretary and treasurer of the Chicago Pneumatic Tool Co., succeeding J. G. Grimshaw, secretary and treasurer, resigned.

Stanley Evans, Fort Smith, Ark., has erected a new crushing plant at Fayetteville, Ark., the equipment including No. 13-A and No. 10-A Telsmith breakers and a No. 32 Telsmith reduction crusher.

L. J. Kanitz, general sales manager of Continental Motors Corp., has announced the appointment of **W. N. Fitzgerald, Jr.**, to the sales department of the industrial division. Mr. Fitzgerald has had a wide and varied experience in the industry, having previously been associated with the A. O. Smith Corp., Milwaukee, the International Harvester Corp., and the Wisconsin Engine Co.

Obituary

Dowell Smith, 42, and **Fred Nickels**, 36, quarry employees at Bluff City, Tenn., were killed June 23 when several tons of rock and dirt fell upon them as they were drilling at the foot of a cliff.

William Henry Bristol, inventor of the Bristol phone and numerous recording instruments, and president of the Bristol Co. of Waterbury, died recently at New Haven, Conn. He was 70 years old.

Coming Events

July 2-10, 1930. Scarborough, England. Exhibition of Quarrying and Building Contractors' machinery and materials. Exhibition Organizers, 53 Broad St., Birmingham, England.

July 10, 1930. Pittsburgh, Pa. Organization meeting, National Ready-Mixed Concrete Assn. V. P. Ahearn, executive secretary, National Sand & Gravel Assn., Munsey Bldg., Washington, D. C.

July 16, 1930. New York, N. Y. Meeting for clay producers at the New York Athletic Club. W. J. Parker, Commissioner, 7 East 44th St., New York, N. Y.

July 29, 1930. Austin, Tex. Annual meeting, Texas Sand and Gravel Producers' Assn. Austin Hotel. W. W. Carson, executive engineer, Littlefield Bldg., Austin, Tex.

Sept. 9, 1930. Seattle, Wash. Portland Cement Association regional safety meeting, at New Washington Hotel. A. J. R. Curtis secretary, 33 W. Grand Ave., Chicago, Ill.

Sept. 9, 1930. Chicago, Ill. Regular meeting, Gypsum Assn., Bismarck Hotel. Henry J. Schweim, executive secretary, 211 W. Wacker Drive, Chicago, Ill.

Sept. 16, 1930. San Francisco, Cal. Portland Cement Association regional safety meeting, at St. Francis Hotel. A. J. R. Curtis, secretary, 33 W. Grand Ave., Chicago, Ill.

Sept. 23, 1930. Ogden, Utah. Portland Cement Association regional safety meeting. Hotel Bigelow. A. J. R. Curtis, secretary, 33 W. Grand Ave., Chicago, Ill.

Sept. 29-Oct. 3, 1930, Pittsburgh, Pa. Annual congress and exposition. National Safety Council, William Penn Hotel. W. H. Cameron, managing director, 20 N. Wacker Drive, Chicago.

Oct. 7-10, 1930. Washington, D. C. Sixth International Road Congress under auspices American Road Builders' Assn. Charles Upham, engineer-director, National Press Bldg., Washington, D. C.

Dec. 1-5, 1930. Memphis, Tenn. Ninth Annual Asphalt Paving Conference of the Asphalt Institute. Meeting of the Association of Asphalt Paving Technologists in conjunction.

Dec. 1-6, 1930. New York, N. Y. National Power Show, Grand Central Palace.

Jan. 27-29, 1931. St. Louis, Mo. Annual convention National Sand & Gravel Assn., Hotel Jefferson. V. P. Ahearn, executive secretary, Washington, D. C.

Marl Deposit Stripped by Tractor and Loader

One of the raw materials used in the manufacture of cement at the Bay Bridge, O., plant of the Medusa Portland Cement Co. is marl which occurs in that vicinity in beds of from 8 ft. to 14 ft. in thickness and overlaid by 12 to 18 in. of humus or muck.

Such organic material is objectionable in cement production for two reasons. First, its intermixture with the marl tends to increase the water requirements in the raw slurry in order to obtain the desired fluidity.

Stripping overburden at the marl deposit.

Utilizing the machine to "throw" track.

Second, the roots of the vegetable growth in the overburden causes considerable trouble in the plugging of screens.

To eliminate this material, stripping is done with a Caterpillar 30 tractor equipped with a Killifer loader. The tractor and loader work ahead of the shovel leaving the clean marl exposed for excavation. This system has been in use for three years and, according to A. J. Little, superintendent, the cost of stripping has been extremely low, averaging only $0.0034 per ton last year, when 180,000 tons of marl were excavated.

As the stripping operations do not require the full time of the tractor and equipment, they are utilized also in grading for trackage and for "throwing" the track in both the marl and clay fields of the company.

Carrying ties and rail for track extension.

Largest Dynamite Plant Celebrates Anniversary

Executives of E. I. du Pont de Nemours & Co. and employees joined in an observance of the fiftieth anniversary of the Repauno plant at Gibbstown, N. J., on Thursday, June 19. Although the anniversary date was actually June 17, it was found to be more convenient to have the celebration two days later.

In the afternoon several hundred employees of the plant held a picnic at which addresses were made by Lamot du Pont, president of the du Pont company; J. W. McCoy, general manager of the high explosives manufacturing department, and others. P. C. Kaiser, plant manager, presided, while assistance in making arrangements was given by H. K. Babbitt, director of the high explosives department.

A number of pioneers in the American manufacture of dynamite were present. One of these was Herbert G. Chase, who was an employee of the Repauno plant when the first building material was delivered for the construction of the initial units. Mr. Chase occupied an executive position at the plant for forty-one years until he retired nine years ago. Another veteran who participated in the celebration was H. Frank Young who is still in active service after having completed a half century of service at the Repauno plant.

Though the Repauno plant is now a unit of the du Pont company's explosives department it was originally known as the Repauno Chemical Co. which was incorporated in Delaware, June 17, 1880, with the du Pont company and a subsidiary owning two-thirds of the stock. The first president of the Repauno Chemical Co. was Lamot du Pont, father of the du Pont who is now president of the du Pont company.

The Repauno plant is said to be the largest dynamite plant in the world, a fact which exceeds the prediction of its first president who expressed the belief that it would become the largest in the United States.

Medic Notes Big Improvement in Dust Collection at Cement Plants

In its earlier years, the Portland-cement industry was subjected to severe censure because of its abundant dust which impaired the health of its employees, polluted the outside atmosphere, and disfigured or injured surrounding properties and landscapes. That these objectionable features have been overcome successfully is attested by the following item in the Chicago *Tribune* written by the eminent medical authority, Dr. W. A. Evans.

"Up-to-date cement works are fairly free from dust. The air in such an institution should not predispose to either consumption or pneumonia. Recently Dr. Hall, state health director of Illinois, and his board were invited to inspect the Buffington cement works and the Gary steel mills. In the Buffington plant they found that the various machines which were great dust producers were operating under suction pipes with draft sufficiently strong to pull the dusty air out of the room. The dust was conducted to high stacks equipped with Cottrell dust precipitators. The Cottrell method consists in sending a sheet of electricity across the stack and, therefore, through the dust-laden, ascending current of smoke and air. When this apparatus was in use the air and smoke pouring from the stack was almost dust free. When the current was turned off and the Cottrell installation was not working, a black mixture rolled from the stack, polluting the air for a long distance roundabout.

"Over in one corner was an old plant built and operating under the old system. It was enveloped by a cloud of dust. Dust issued from all the openings and belched from the stacks. The visitors were told that the new method not only secured clean air and all that that implied for the health and welfare of the workmen, but that in saving 95 per cent of the cement which formerly went out the stacks it was earning its way as a financial proposition.

"Once the trees and other vegetation within several hundred yards were dust covered and unhealthy. Now they are green and thriving."

Minnesota Is Building 566 Miles of Highways

The road building program for Minnesota for this year will be as large as any yet handled by the Department. About 43 per cent of the system of 6,955 miles has been improved.

It is proposed to build 266 miles of concrete and 300 miles of gravel this year, as well as 350 miles of grading, with the $18,000,000 available.

To keep the highways in first class condition, $4,500,000 will be spent for maintenance.

Road-Maintenance Work in Maine Is Increasing

It is expected that highway construction in Maine will be about the same this year as for 1929. A considerable increase is expected in the construction of secondary, or state-aid, roads. Third-class highway construction will be about the same as for 1929.

Maintenance work will increase over 1929, especially in bituminous surface treatment of gravel roads. It is planned to treat about 1,500 miles in 1930. This work included about 1,000 miles in 1929.

Canadian Mines Branch Publishes Mica Report

The Mines Branch of the Department of Mines, at Ottawa, has recently published a comprehensive report dealing with Canadian mica occurrence and with the mica industry in general. The more important foreign deposits are also described, and information is given on methods of preparation for market, the manufacture of mica products, utilization of waste mica, mica grinding, marketing, etc.

This report, prepared by Hugh S. Spence, comprising 134 pages of text and 31 illustrations, entitled—Mines Branch Publication No. 701—may be obtained on application to the Director, Mines Branch, Dept. of Mines, Ottawa, Can.

Texas Sulphur Co. Will Build at Freeport, Texas

The Freeport Texas Co., Freeport, Tex., is planning an expansion of its sulphur-mining interests at Hoskin's Mound, near Freeport. Expenditures for additions and improvements to the existing plant are estimated at $250,000 and will consist of the realization of a program laid out by the company's research department including methods of treating water supply, use of flue gases for preheating feed water and various other engineering processes conducive to economy and increased production.

Blue Island Firm Buys Abandoned Pipe Factory

Briggs & Turivas, Inc., Blue Island, Ill., have purchased the abandoned steel-pipe and pipe-coupling plant at Zanesville, O., from the Youngstown Sheet & Tube Co., for dismantling or resale.

Types of Employers Are Analyzed by School Head

In addressing a luncheon of business men in Toronto, Ont., recently, A. L. Body, principal of the Sheldon Schools, analyzed the various types of employers and their attitudes toward employees. His talk was reported in the Toronto *Board of Trade Journal* as follows:

"Mr. Boyd classified employers into four divisions, as exploiters of men, buyers of *morale*, paternalists and democratic fraternalists. Exploiters of men were explained as the type of employers who looked upon employees as so many material goods and adopted the attitude of demanding of an employee that he get in line or get out. Such employers are, very fortunately, few in number, but the influences they create are the sources of radicalism in the present day and the historic source of the growth of trade unionism. Employers of this class will never understand their employees and the opinion was expressed that any body of employees who can get the leadership, to which they as human beings are entitled, from within the organization for which they are working, will not submit to dictation of labor organizations from without.

"Buyers of *morale*, the speaker explained, were the employers who felt that money alone could buy from their employees a fighting spirit and zeal in their work. This, he said, was a fallacious idea, for one of the great lessons learned in the war had been that although wages progressively went higher, *morale* and efficiency of production became lower.

"The paternalistic type of employer, he explained, was the one who engaged in welfare work in an autocratic way as a matter of policy because it was thought to be profitable. This type of employer cannot get the best from employees because he overlooks some of the fundamental elements of human nature, and, through giving the employees only what he wants, he does not give them what they want, and the result is that his efforts are unappreciated and wasted.

"Finally, attention was called to the democratic, fraternalistic employers who were the ideal to which all employers should strive. Such employers were good executives, capable managers of men, understood human nature, and their greatest task is to teach employees the fundamental ideas of human activities.

"In examining the factors upon which success is based the speaker pointed out that they consist of material, men, money and *morale*, and that it was the last of these which turned all others into the invincible power that produced success. *Morale*, in turn, Mr. Boyd stated, was made up of the conscious factors of confidence in management, satisfaction as to wages and conditions of labor and interest in work."

Financial News

The information contained in these financial pages is given with the understanding that any statement on the part of this magazine or any of its staff, as to the responsibility or standing of any person, firm or corporation, or as to the value of any property or securities is a mere expression of opinion, given as a matter of service to the readers of PIT AND QUARRY, *for which no responsibility in any way is to attach to this magazine or to any of its staff.*

Warner Co. Anticipates Excellent Third Quarter

Current bookings of the Warner Co. indicate good deliveries of its materials over the next four months, so that the company faces a continuation of favorable earning conditions for the third quarter.

Since the first of the year the company has spent $175,000 in the Philadelphia delivery division. Earnings so far this year have been running at a satisfactory rate. In the first quarter, the company covered all of the current charges for interest and preferred dividends, despite the fact that, normally, due to seasonal conditions, building operations reached the lowest point of the year over that period.

For the first nine months of its operation, ended December 31, 1929, the Warner Co. reported net income of $1,318,130; equivalent after preferred dividends to $4.25 a share on the then outstanding 204,727 shares of no-par-value common stock.

During the past winter and early spring, the Warner Co. effected a number of economies in plant operation and, in addition, planned to expand business of profitable departments, at its operations on the Upper Delaware River, a few miles below Trenton, and on the Pennsylvania Railroad between Tullytown and Morrisville. Improvements designed to effect further economies in handling and sizing the dredged sand and gravel products were completed at the three larger units, the Manor, Terminal and Van Sciver plants. Furthermore, a consolidation was effected involving three of the smaller units in that area by which one improved plant does the work of three.

Recent extensions included the enlarging of carloading facilities at the local Berks Street plant in order to permit the handling of from 80 to 100 carloads a day. The new rock-crushing plant there has been completed and is in operation, as is the additional Smith mixer in the new central concrete plant. (See PIT AND QUARRY, May 7, 1930, page 51.)

The Warner Co.'s first twelve months of operations were concluded April 30, last and over the period the company retired $1,366,620 of underlying obligations through bond and preferred-stock sinking-fund operations and payments on purchase money contracts, which effected savings in interest and preferred-stock dividend charges at the rate of $72,031 annually.

International Salt Co. Stock Split-up Approved

On June 17, 1930, the stockholders of the International Salt Co. ratified the change of the stock from $100-par to no-par-value and the issuance of three no-par-value shares for each $100-par share outstanding. The number of shares will be increased from 60,000 to 240,000.

The company was offering 60,000 additional shares of new no-par-value stock to shareholders of record June 3 at $36 a share in the ratio of one new share for each three new no-par-value shares held. The rights will expire July 21, 1930.

Proceeds from the sale of the new stock will be used to finance the acquisition of the Sterling Salt Co. and for other corporate purposes.

Canada Cement Company Reports Outlook Good

While it is too early to forecast, with any degree of accuracy, the probable showing of Canada Cement Co., Ltd., for the current fiscal year, ending November 30, 1930, still the present indications are that the company will do fully as well as last year, and probably better.

An important factor influencing Canada Cement's business is that, despite temporary slowing up in general business in the Dominion, due largely to the grain tie-up, most of the Canadian provinces are planning record highway construction programs, including power developments and various types of building operations.

The company's business is most active of course during the summer months. Shipments during the first two or three months of the fiscal year probably represent no more than 10 per cent of the year's total. Winter production of the company is dispatched to various central distributing points, to be ready when the construction season starts. It is understood operations were maintained at a relatively high level during the past winter in anticipation of good business this summer.

For the fiscal year ended November 30, 1929, Canada Cement reported net income of $1,600,701 after depreciation, interest and reserves, equivalent after 6½ per cent dividend requirements, to 38 cents a share on 600,000 shares of no-par common stock. This compared with $1,396,951 or 5 cents a share on the common in the previous fiscal year.

CURRENT DIVIDENDS

COMPANY	CLASS OF STOCK	DIVIDEND RATE	HOLDERS OF RECORD	PAYABLE
Alpha Portland Cement	Common	$.50 qr.	July 1	July 25
American Aggregates Corp.	Preferred	1¾% qr.	June 20	July 1
Boston Sand and Gravel	Preferred	$.87½ qr.	June 22	July 1
Boston Sand and Gravel	Common	$.40 qr.	June 22	July 1
Calaveras Cement Co.	7% Pfd.	1¾% qr.	June 30	July 15
Canada Cement	6½% Pfd.	1⅝% qr.	May 28	June 30
Canada Gypsum and Alabastine	Common	$.37½ qr.	June 14	July 1
Cleveland Builders Supply	Common	$.50 qr.	June 15	July 1
Consolidated Oka Sand and Gravel	Preferred	1¾% qr.	June 27	July 1
Consumers Co.	Pr. Pfd.	$1.50 qr.	June 15	July 1
Coronet Phosphate Co.	.....	$2.00 qr.	June 14	July 1
Dolese and Shepard	.....	$2.00 qr.	June 20	July 1
Dufferin Pav. and Crushed Stone	7% Pfd.	1¾% qr.	June 17	July 1
Ideal Cement Co.	Common	$1.75 qr.	June 13	July 1
Illinois Brick	.....	$.60 qr.	July 1	July 15
International Cement	Common	$1.00 qr.	June 11	June 30
International Salt	Common	$2.00 qr.	June 16	July 1
Johns Manville	Preferred	$1.75 qr.	June 11	July 1
Johns Manville	Common	$.75 qr.	June 25	July 15
Kelley Island Lime and Transport	.....	$.62½ qr.	June 20	July 1
Kentucky Rock Asphalt	Common	$.40 qr.	June 15	July 1
Lawrence Portland Cement	.....	1% qr.	June 14	June 30
Lehigh Portland Cement	.....	1¾% qr.	June 14	July 1
Limestone Products	7% Pfd.	1¾% qr.	June 15	July 1
Medusa Portland Cement	Preferred	1½% qr.	June 25	July 1
Medusa Portland Cement	Common	$1.50 qr.	June 25	July 1
Metropolitan Paving Brick	Preferred	$1.75 qr.	June 15	July 1
Mineral Products Co.	Pfd. "A"	$.20 qr.	June 30	July 1
Newaygo Portland Cement	Preferred	$1.75 qr.	June 26	June 30
New York Trap Rock	Preferred	$1.75 qr.	June 20	July 1
Peerless Cement	Preferred	$1.75 qr.	June 20	July 1
Pennsylvania Salt	Common	$1.25 qr.	June 30	July 15
Santa Cruz Portland Cement	.....	$1.00 qr.	June 24	July 1
Sterling Salt	Common	$.50 qr.	June 24	July 1
Superior Portland Cement	Class A	$.27½ M	June 18	July 1
United States Gypsum	Preferred	$1.75 qr.	June 15	June 30
United States Gypsum	Common	$.40 qr.	June 15	June 30
Warner Co.	1st Pfd.	$1.75 qr.	June 15	July 1
Warner Co.	Common	$.50 qr.	June 30	July 15
Worcester Salt Co.	Common	1¼% qr.	June 24	July 1

Traffic News and Comment

Chamber of Commerce to Fight New Freight Rates

The Elberton Granite Association and the Elberton Chamber of Commerce of Elberton, Ga., are actively engaged in attempts to prevent the proposed schedule of freight rates on granite and marble, submitted to the Interstate Commerce Commission by the railroads, from going into effect.

The proposed tariff, it is said, will mean an increase of 75 per cent over the existing schedule and cause a sensible reduction in production from this region.

New Complaints Filed

No. 23,412 *Sub.* 1—*J. T. Maguire.*

Attacks rates on roofing slab. Reading, Bethlehem and Hokendaqua, Pa., to Pawtucket, R. I. Asks for reasonable rates and reparation.

No. 23,471—*White Eagle Oil Corp.*

Attacks rates fuller's earth, Quincy and Jamieson, Fla., to August, Kan., and North Fort Worth, Tex. Seeks reasonable rates and reparation.

No. 23,501—*Shreveport Chamber of Commerce for Meridian Fertilizer Factory, et. al.*

Attacks rates and minimum weight on phosphate rock from New Orleans and West Westwego, La., to Shreveport, La. Seeks rate of 9½c and reparation.

No. 23,534—*California Portland Cement Co.*

Seeks unjust and unreasonable rates on cement from Colton, Cal., to points in Utah.

Classification Changes

Consolidated Classification Committee Docket No. 42 contains petitions for changes in rules, descriptions, ratings, and minimum weights which will be considered.

Hearings will be held at Atlanta, Ga., July 9; Bluff Point, N. J., July 15; and Chicago, July 22, 1930. These hearings are by appointment and anyone interested in any of the changes proposed will be heard by the committee at any one of the places mentioned if application is made.

Molding Sand

Eastern trunk-line railroads have been asked to revise the rates on moulding sand from Round Lake, Ballston, Ballston Spa, Lake, Saratoga Springs and Gansevoort, N. Y., to all destinations in Central Freight Association territory to a new basis, reflecting an arbitrary of 30c per ton over the rates now in effect from the Albany group.

It has been stated that the object of this revision is to place the rates on a uniform basis to the destination territory involved. (Trunk Line Association Docket 23,911.)

Crushed Stone

The Central Freight Association lines have under consideration in their Docket 25,300 a request from shippers of crushed stone, located at Apex, O. Some of the changes sought are shown below:

To	Present rate	Rate sought
Akron, O.	$1.05	$1.00
Barberton, O.	1.15	1.00
Cleveland, O.	1.15	1.05
Kent, O.	1.05	1.00
Talmage, O.	1.05	1.00
Bedford, O.	1.05	1.00
Youngstown, O.	3.40	1.00
Canton, O.	2.60	0.85

At the request of one of its shippers the Wabash Railway has asked the Central Freight Association roads docket for consideration of reductions in the present rates on crushed stone from Huntington, Ind., to various destinations on the Wabash in Ohio. The following are typical of the proposed as well as present rates:

To	Proposed rates	Present rates
Alvordton, O.	$1.00	$1.10
Baldwin, O.	0.95	1.07
Eden, O.	1.00	1.10
Elmira, O.	0.95	1.10
Montpelier, O.	0.95	1.05
West Unity, O.	0.95	1.10

Puts Drill-Steel Shop Under Automatic Control

Recognizing that it is impossible to properly forge, heat and subsequently harden drill bits by the hand-and-eye method, the H. E. Fletcher Co. of West Chelmsford, Mass., producers of Chelmsford granite, has recently installed a complete automatic drill-steel shop equipment. This consists of a Gilman automatic forging furnace, an automatic heat-treating machine for all jackhammer and channel-bar drill-steels, and an automatic combined forging and tempering furnace for plug-drill steels.

By the use of this equipment which eliminates the personal equation almost entirely from the heating and tempering operations, it is planned to so improve the quality of the drill bit that only one-half the number of drill-steels formerly used will be required to produce the same footage of drill-hole.

Sand and Gravel

The Illinois Central and Chicago, Rock Island and Pacific Railroads have been ordered to make effective new rates on sand and gravel from Ottawa, Ill., to 43 destinations in the state of Illinois. Complaint against the present rates was filed by the Moline Consumers Co. with the Illinois Commerce Commission.

Feldspar

A shipper of feldspar at Campo, Cal., has requested the trans-continental railroads to reduce the present rate of $11.60 per ton to destinations in Indiana, Ohio, Michigan, western Pennsylvania and western New York to $10 per ton, with proportionate reductions to points in the West. The subject is covered by Trans-Continental Freight Bureau Docket 11,223.

Export Organization of Blaw-Knox Changes Name

Blaw-Knox International Corp. is the new name of the export organization of the Blaw-Knox Co., which was formerly known as Milliken Brothers-Blaw-Knox Corp., which in turn succeeded the original Milliken Brothers Mfg. Co. The change of name embraces no change in personnel and the offices will remain as formerly, in the Canadian-Pacific Bldg., New York, N. Y.

Blaw-Knox International Corp. handles all the products of the Blaw-Knox Co., including clamshell buckets, central-mixing plants, steel bins, measuring batchers, dragline buckets, and Agitator truck bodies.

Organized Labor Plans School for Engineers

The International Union of Operating Engineers, affiliated with the American Federation of Labor is proceeding with the organization of a definite program of instruction covering hoisting and portable equipment.

C. E. Haury, general organizer of the I. U. of O. E., states that while the school is primarily intended to cover hoisting and portable equipment, additional instruction covering the machinery used in pits and quarries will be included.

It is thought that general safety rules and accident prevention will also receive serious attention and be incorporated in the course of instruction given.

Review of Foreign Practice

Valve-Bag Packer Uses Shorter Type of Sacks

The lime industry suffers even more difficulties in packing its product than the cement industry, on account of the lighter weight of the materials which, heretofore, has required the use of inconvient and relatively costly large sacks. The Andreas bagger and paper sack which have been developed recently completely avoid this difficulty, and offers advantages in the sacking of any pulverized material such as cement, lime, and gypsum which, when loaded into containers, increase in bulk on account of air trapped between the particles. The bagger is an automatic device which gives the sack an appropriate shaking while it is being filled, thereby packing the material down in more solid form and in less space. The sacks used with the device are from 5 to 10 cm. shorter than the sacks formerly required, and the sacks are convenient and easy to handle in practice. The machine is in general of the same construction as other types of baggers: the material fed from the silos is passed through a sieve-drum to eliminate any foreign particles, then to a distributing screw to a weighing hopper, and from the hopper passes down to the bagging spouts. One man can operate a four-tube bagging machine comfortably.—*Tonindustrie-Zeitung* 54: 709-710, May 26, 1930.

Classification of Sizes of Stone, Sand, Gravel

There is a considerable lack of uniformity in the various sizes of sand, gravel and crushed stone on the market in Germany, and along with it some difficulties because of varying nomenclature; and efforts are being made to secure a standardization of the market sizes. The author of this article points out some of the difficulties in the way of such standardization, particularly difficulties that must modify any attempts at standardization. One of these is that screening through either round or square holes will never give an absolutely true and uniform sizing of a three-dimensional material, unless it be of ideal shape such as the sphere, and the further the material varies from this ideal shape the greater the variation in results; also, the results on round and square holes will vary between themselves according to the material, unless it be of the ideal form. Materials of different structure, texture and hardness, break in different ways that will influence the nature of the material passing a screen of a given size, and the type of crusher, furthermore, will give a similar variation. Other factors that vary the results from the screening process are the factors of the screening itself—the number of revolutions per minute and, in a vibrating screen, the number and severity of the impacts. It seems probable that the only acceptable standardization is one that will delineate sizes within given upper and lower limits, with provisions for the approximate grading of the various sizes between those limits.—*Steinindustrie* (Berlin) 25: 185-186, May 29, 1930.

German Cement Plant Producing at Carsdorf

The Aktiengesellschaft Kursachsen Portland-Zementwerke has built a new cement plant at Carsdorf a. U., in the vicinity of Naumburg a. S., in the midst of the great German industrial region and near the lignite pits of middle Germany. The first part of the plant went into operation in the fall of 1928, and at the same time the company started plant extensions so that the whole plant as it now stands was completed in the summer of 1929. It has a capacity of 500 tons per day.

The raw materials are limestone (the widely used German "Muschelkalk") and clay, and the plant operates by the dry process. The limestone is mined at a quarry about 500 meters distant from the plant and 70 meters above it, and it is blasted down and loaded by hand to cars which are carried to the plant by an aerial tramway which, because of the difference in elevation, uses no power. The stone passes through a jaw crusher and a roll crusher and is conveyed to bins over the raw mills. The clay is dug near the plant and conveyed to similar storage bins. The stone and clay (as well as two additional materials when making special high-strength cement) are fed through table feeders to either of two Unidan three-compartment mills, and the slurry is troughed to the sump of the slurry-agitating basins. It is there lifted by large slurry elevators in concrete shafts to the distributing device above the three cylindrical silos, where the slurry is agitated by compressed air. The same elevators carry slurry from the tanks to the kiln feeders.

Slurry feeders of special construction feed the slurry into two Unax kilns and, from the coolers that are integral with these kilns, the clinker is carried by shaking troughs to a chain-drag conveyor (Cylcup conveyor) which carries the clinker to storage and later reclaims it to the bins in the finish grinding department. The clinker and gypsum are fed to two four-compartment Unidan mills, and the ground cement is carried by screw conveyor and elevators to four cylindrical cement silos. From these the cement is reclaimed by pneumatic Flux conveyors to a bin over the packing plant, where it is sacked and loaded to cars automatically.—*Zement* 19: 464-467, May 15, 1930.

Norwegian Cement Plant Effects Boost in Output

At the Dalen Portland Cementfabrik in Norway, many improvements have been made in a process of rationalization that has been going on since 1920, with the result that, where, in 1920, the plant produced 400,000 bbl. with 450 men (890 bbl. per man), in 1928 it produced 882,000 bbl. with 225 men, or 3,920 bbl. per worker. Much of the saving in labor has been effected in the quarry due to the adoption of steam shovels and large crushers, and the quarry workers have been reduced from 110 in 1920 to 25 in 1928.

Activities in Foreign Cement Industry

New Zealand. New Zealand has a protective tariff on cement, and the domestic mill, Wilsons (N. Z.) Portland Cement, Ltd., near Whangarei, supplies practically all requirements. The plant is of modern design and is favorably situated close to raw materials, fuel, hydro-electric power, and deep-water port facilities. It produces a quick-setting high-strength cement, but white cement is imported.

East Africa. Importation of cement in the East African colonies increased from 15,977,682 kg. in 1923 to 19,221,000 kg. in 1926. The importation of lime and hydraulic lime was, in 1926, 11,921,000 kg. The largest amount of cement is used in Senegal, with Guinea next. Most of the lime and cement comes from France, with some from Belgium, England and Germany.

Algeria. A new lime and cement plant is to be erected at Hamman-Lif near Tunis to furnish materials to Tunis and Tripoli.

Poland. The Wolyn cement plant at Zdolbunowo, which was destroyed during the war, has been rebuilt and will export cement to Russia and Roumania.

Czechoslovakia. The Stramberger Zement- und Kalkwerke A. G., Stramberg, is converting its lime plant into a cement mill, at a cost of about 15,000,000 crowns.

Brazil. Brazilian and Swiss interests are reported to be planning the construction of a cement factory at Carandahy in Minas Geraes.

Recent Patents

AMERICAN

Concrete

Device for making concrete test samples. Charles S. Howe, Los Angeles, Cal., assignor to Los Angeles Testing Laboratory, same place. No. 1,762,440.

Paving mixture and process of preparing same. Edwin C. Wallace, Newton, Mass. No. 1,763,204.

Grinding and Pulverizing

Grinding cement materials, etc. Carl Pontoppidan, Copenhagen, Denmark, assignor to F. L. Smidth & Co., New York, N. Y. No. 1,762,241.

Coal pulverizer. Harry H. Bates, Ridley Park, Pa., assignor to Westinghouse Electric & Mfg. Co. No. 1,762,379.

Pulverizing apparatus. L. V. Andrews, Worcester, Mass., assignor to Riley Stoker Co., same place. No. 1,763,496.

Disintegrating machine. Diedrich C. Addicks, Rockmart, Ga. No. 1,764,138.

Pulverizing machine. Benjamin A. O'Neill, Minneapolis, Minn., assignor to Schutz-O'Neill Co., same place. No. 1,765,309.

Material Handling

Excavator trip. Arthur Orloff, Green Bay, Wis., assignor to Northwest Engineering Corp., same place. No. 1,762,523.

Mine car. Hugh W. Sanford and Perry S. McCallen, Knoxville, Tenn., assignors to Sanford Investment Co., Wilmington, Del. No. 1,762,667.

Worm-drive crane. Erich Lichtenberg, Milwaukee, Wis., assignor to Koehring Co., same place. No. 1,763,617.

Excavating tool for ditching or dredging machines. Hinko Fischer, Lubeck, Germany. No. 1,763,769.

Material excavating and conveying machine. William M. Huffman, Kentenia, Ky. No. 1,763,786.

Grab-bucket. Robert W. Kaltenbach, Cleveland Heights, O. No. 1,763,790.

Excavating machine. William J. Newman and John P. Carroll, Chicago, Ill. No. 1,763,810.

Excavator. Howard Marks, Newman, Cal. No. 1,764,518.

Back-digging excavator. Emery J. Wilson, Cleveland, O., assignor to Thew Shovel Co., Lorain, O. No. 1,764,922.

Miscellaneous

Mining machine. John H. Blair, Chicago, Ill. No. 1,762,154.

Filler for building units and process of preparation. William A. Freret, Washington, D. C., assignor to National Lime Assn., same place. No. 1,762,267.

Manual control means for bucket-cleaners. Harry B. VanScoit, Findlay, O., assignor to Buckeye Traction Ditcher Co., same place. No. 1,762,492.

Bucket or grapple. Herbert S. Atkinson, East Orange, N. J., assignor to Hayward Co., New York, N. Y. No. 1,762,946.

Rotary cutting, mixing, and attrition mill. Robert C. Hopkins, Alliance, O. No. 1,764,020.

Cellular structural material. Harry E. Brookby and George D. King, Chicago, Ill., assignors to United States Gypsum Co., same place. No. 1,764,824.

Method for driving lining-tubes for molding concrete piles in the ground. Edgard Frankignoul, Liege, Belgium. No. 1,764,949.

Power trip. Thomas F. Stringer, Lorain, O., assignor to Thew Shovel Co., same place. No. 1,764,993.

Semi-automatic dipper-trip and monkey-line winder. George G. Morin, Holyoke, Mass. No. 1,765,089.

Mixing

Transit concrete mixer. Joseph E. Morris, Seattle, Wash. No. 1,763,249.

Method of preparing pavement composition. Meldrum D. Shannon, Sacramento, Cal. No. 1,764,534.

Concrete mixer and the like. Eugene J. Stern, Little Rock, Ark. No. 1,764,583.

Screening

Rotary grizzly. John H. Odenbach, Herman Coldman, and William C. Henry, Rochester, N. Y., assignors to Dolomite Products Co., same place. No. 1,462,790.

FOREIGN

Cement and Concrete

Ferroconcrete beams and floors. F. Schlagintweit. British 309,083.

Cement compositions. H. Cadman and N. Cadman. British 329,107.

Cement and process for its manufacture. A. Carpmael (Societe pour l'Exploitation des Procedes Petrus). British 305,170.

Impermeable insulating and waterproof cement paste. Societe Anonima Invenzione Guadanin. French 686,193.

Process and apparatus for treating cement slurry before its burning in the rotary kiln. N. Nielsen. French 685,982.

Crushing and Grinding

Compartment mill with a preliminary-grinding chamber and a fine-grinding chamber of smaller diameter separated from the former by a sieve-wall or intermediate chamber. Allis-Chalmers Mfg. Co. German 499,219.

Drive for tube or trommel mills. Carl Wiltrock. German 499,556.

Apparatus for preparation of pulverized coal. Wirth & Co. G. m. b. H. German 499,272.

Colloid mill. Siemens & Halske Akt.-Ges. German 499,557.

Grinding mill. George F. Pettinos. Canadian 300,500.

Pulverizing machine. Jeffrey Mfg. Co. (Walter J. Armstrong). Canadian 300,595.

Grinding bodies for tube or drum mills. Helipebs, Ltd., and R. McDougall. British 329,131.

Cooling of grinding mills. M. Treschow. British 328,634.

Pulverizing mills. International Combustion, Ltd., and F. H. Rosencrants. British 329,061.

Drilling

Reciprocating or percussive tools. A. T. Holman and K. J. Holman. British 328,685.

Pneumatic percussive tools. F. Krupp Akt.-Ges. British 316,933.

Chuck for rock drills. Ingersoll-Rand Co. British 329,007.

Reciprocating or percussive tools. A. T. Holman and K. J. Holman. British 328,977.

Deep-drilling apparatus. W. R. MacDonald. British 328,629.

Apparatus for compressed air hammers, particularly drilling hammers. Friedrich Krupp Akt.-Ges. German 499,145.

Dryers

Drying installation for the aggregates in asphalt preparation. Wilhelm Geldmacher. German 499,207.

Rotary dryer. Zeitzer Eisengiesserei und Maschinenbau Akt.-Ges. German 499,140.

Gypsum

Manufacture of gypsum wallboard. Gypsum Lime & Alabastine, Canada, Ltd. (George Miller Thompson and Leo Vance Robinson). Canadian 300,582.

Production of building material from Sorel cement or gypsum to which is added a durable colloidal solution, emulsion or suspension. Leo Carl Schilling. Canadian 300,739.

Material-Handling

Shaking conveyor. Maschinenfabrik G. Hausherr. German 499,409.

Filling device for bunkers of pulverulent materials. Friedrich Krupp Akt.-Ges. German 499,410.

Continuous mechanical conveyor for bulk materials. S. A. Compagnie des Transporteurs Simplex and A. Fouchy. French 685,788.

Elevating equipment. Societe Michelin & Cie. French 685,964.

Improvements in endless conveyors and similar devices. W. A. Spriggs. French 686,057.

Device for apportioning the loads in the buckets of aerial ropeway conveyors. Societe Ceretti & Tanfani (S. A.). French 686,337.

PIT AND QUARRY will furnish, at its actual cost, a copy of any patent cited above. A charge of ten cents per copy is made by the U. S. Patent Office, Washington, D. C., and readers may procure a copy directly by addressing the Commissioner of Patents, with payment for copies requested. Postage stamps are not accepted by the Patent office. We will endeavor to obtain copies of foreign patents for our readers but we cannot give assurance in every case for the reason that copies of such patents are not printed for distribution as liberally as are the American copies, nor is there a fixed charge per copy.

Dump car. Henry Fort Flowers. Canadian 300,676.

Crane driving and steering mechanism. The Koehring Co. (Harold E. Brey). Canadian 300,826.

Aerial cableways. J. M. Henderson & Co., Ltd., and R. T. Medd. British 329,172.

Apparatus for dumping railway cars. B. E. Ellson. British 329,177.

Dump cars. Vulcan Motor & Engineering Co. (1906), Ltd., and R. G. Totty. British 329,197.

Self-dumping cars. Harrow Industrial Co., Ltd., and W. E. Herbert. British 328,732.

Wire ropeways. Bleichert & Co. Akt.-Ges. British 314,953.

Motors for operating reciprocating conveyors. R. P. Finlay and Finlay Conveyor Co., Ltd. British 328,883.

Ballast cars. F. B. Dehn (H. S. Hart). British 328,928.

Mixers

Mixing drums for concrete and similar purposes. C. H. Fowler and G. Hobson. British 328,895.

Mixer. E. Christiansen. French 686,252.

Mixing machine. Koehring Co. German 499,427.

Separators

Centrifugal dust separator or extractor. H. Simon, Ltd., and G. Watts. British 328,652 and 328,653.

Rotary separator for extracting finely divided material from air passing through it. Pneumatic Conveyance & Extraction (1929), Ltd. Canadian 300,611.

Separation of intermixed divided materials. R. Peale and R. Peale, Jr. British 328,663.

Miscellaneous

Burners for fuel in a pulverized condition. P. W. Griffin. British 328,682.

Containers for powdered or like material. Hudson, Scott & Sons, Ltd., and P. G. Hudson. British 328,768.

Treatment of stones or stony materials, cement, concrete, bricks, road surfaces and the like. C. G. Fox. British 328,969.

Production of alumina. Jean Charles Seailles. Canadian 300,506.

Pulley block. Carl Alfred Johansson. Canadian 300,695.

Final 1929 Figures on Output of Cement

66 PER CENT OF CAPACITY USED

Statistics relating to the Portland-cement industry in 1929 compiled by the United States Bureau of Mines, Department of Commerce, from the final returns of the producers for the year confirm the estimates published by the Bureau of Mines early in January.

Production of Portland cement in 1929—170,646,036 barrels—showed a decrease of 3 per cent from 1928, the highest year of production.

Shipments of Portland cement from mills in 1929 amounted to 169,868,322 barrels, valued at $252,153,789, a decrease of 3 per cent in quantity and of nearly 9 per cent in gross value. The average factory price per barrel in bulk in 1929 was $1.48, a decrease of 9 cents per barrel as compared with 1928.

Stocks at the mills increased, reaching a total of 23,537,817 barrels on December 31, 1929, the greatest at the end of any year during which official records of stocks have been kept. They were 3 per cent higher than at the end of 1928.

From the reports of the producers showing mill shipments of Portland cement into the various states estimates of per capita consumption in the accompanying table have been compiled. These are at best but approximations as they represent only the records of mill shipments into states; they do not include the imports, which would increase the consumption in certain states near the Canadian border and the seaboard; nor do they make allowance for a variable but considerable stock of cement at all times in transit, in warehouses at distributing points, and awaiting use at jobs.

The commercial capacity for production of finished Portland cement of the 163 plants active at the end of 1929, and of three plants idle in 1929 but producing within the two previous years, according to manufacturers' reports supplemented by a few estimates, was 259,344,000 barrels. This total includes, besides increased capacity due to extensions and improvements at old plants, approximately 7,900,000 barrels capacity for finished Portland cement of 9 new plants that began operating during the year and are located one each in Arkansas, California, Idaho, Nebraska, Pennsylvania, Washington, and Wyoming; and two in Texas. The capacity of two plants reported out of business in 1929 and idle in that year and in 1928, has been excluded from the figures for 1929. The total production for 1929 was 65.8 per cent of the indicated capacity at the close of the year; for 1928 it was 72.3 per cent.

A summary of the monthly estimates of output of Portland cement in 1929, compiled from monthly reports of producers, was published early in January, 1930, by the Bureau of Mines. These estimates, which indicated a production of 170,198,000 barrels and shipments of about 169,394,000 barrels, were within 0.3 per cent each of 1929 figures.

The table at the bottom of the page shows the manufacturing capacity of the mills in the United States by commercial districts for 1928 and 1929.

Western Engineers Form Committee on Minerals

The Western Society of Engineers, which has functioned continuously since 1859 with headquarters in Chicago, Ill., recently created a Mineral Industries Committee whose functions will be to develop programs, promote activities that will prove helpful to the mineral industries, prepare exhibits of mineral resources, and diffuse scientific information relating to such resources. This committee comprises: C. C. Whittier, chairman, John A. Garcia, E. T. Lednum, M. M. Leighton, A. J. Hoskin, H. Filippi, W. D. Langtry, W. F. Plambeck, and J. D. Burlie.

American Arch Co. Moves to New N. Y. Location

The American Arch Co., manufacturers of air-cooled walls and suspended arches for boiler furnaces and industrial furnaces, announces the removal of its main offices from 17 East 42nd St. to the Lincoln Bldg., 60 East 42nd St., New York, N. Y.

PORTLAND-CEMENT MANUFACTURING CAPACITY OF THE UNITED STATES, BY COMMERCIAL DISTRICTS, 1928 AND 1929

District	Estimated Capacity (*bbl.*)		Percentage of Capacity Utilized	
	1928	1929	1928	1929
Eastern Pennsylvania, New Jersey, and Maryland	50,945,000	53,983,000	77.9	69.9
New York and Maine	17,037,000	18,449,000	67.4	61.9
Ohio, Western Pennsylvania, and West Virginia	24,671,000	26,400,000	74.3	67.9
Michigan	19,508,000	18,535,000	71.0	74.2
Wisconsin, Illinois, Indiana, and Kentucky	27,057,000	29,293,000	84.1	73.0
Virginia, Tennessee, Alabama, Georgia, Florida, and Louisiana	24,667,000	25,034,000	64.7	55.1
Eastern Missouri, Iowa, Minnesota, and South Dakota	22,993,000	22,661,000	72.6	69.3
Western Missouri, Nebraska, Kansas, Oklahoma, and Arkansas[1]	14,598,000	17,563,000	74.9	70.6
Texas	7,700,000	9,950,000	82.4	74.1
Colorado, Montana, Utah, Wyoming,[1] and Idaho[1]	5,567,000	6,669,000	49.8	40.4
California	22,700,000	23,350,000	59.7	56.1
Oregon and Washington	6,259,000	7,457,000	63.3	45.5
	243,702,000	259,344,000	72.3	65.8

[1]Arkansas, Wyoming, and Idaho began producing in 1929.

Legal Information for Operators

Gravel Firm May Make Own Switching Charges

A common carrier is bound by the public utilities or public service commissions' regulations regarding transportation rates, switching charges and the like. However, it is important to know that this rule is not applicable with respect to private carriers or private corporations.

For example, in National Sand & Gravel Co. v. Janes Contracting Co., 126 So. 560, the plaintiff contracted to supply a contractor with sand and gravel to be shipped from the former's pit. It was also agreed that the contractor should pay the gravel company $5 per car for switching charges. Later, the contractor refused to pay $1,245 for switching charges on the contention that the Public Service Commission requires railroad companies to charge according to the rates established by the commission, without discrimination for switching cars for any other railroad with which it connects for intrastate business.

However, the Court held the gravel company not bound by this regulation, and said:

"Plaintiff is engaged in exploiting sand and gravel, and is not engaged in the business of a common carrier for the transportation of freight for the general public. . . . In the instant case, the agreement was made by a private carrier, not engaged in the business of carrying as a public employment, for switching the cars to a designated point for the delivery of the goods in a particular case for a stipulated reward. The contract is not affected by the rates fixed for the regulation of railroads or other public agencies, and is legal, not being contrary to good morals, against public policy, or forbidden by law."

Fails to Ship Quality of Stone as Specified

It is important to know that a material man or sub-contractor can not escape liability for the full damages suffered by an owner, where the former fails to furnish the quality of stone or other building material as laid down in the specifications. This is true, even though the quality supplied is the kind generally used for the particular kind of work.

For illustration, in Biedenharn v. Waters, 126 So. 508, a firm of sub-contractors entered into a sub-contract with a principal contractor to furnish stone in accordance with specifications to be used in the construction of a building. The sub-contractor failed to furnish the exact quality of stone specified. Also, some of the stone had broken corners.

The sub-contractor attempted to avoid liability by proving that he supplied the quality of stone generally utilized in this kind of construction work. However, the Court held the sub-contractor liable in damages, and said:

"It is shown that J. C. Shepherd & Co. furnished the stone under a sub-contract calling for stone according to specifications attached to, and made part of, the original building contract. Therefore, J. C. Shepherd & Co. can not escape responsibility for failure strictly to comply with their contract by now showing that they furnished stone of the average lay of cast stone used by two contractors. . . . It is indisputably shown that some of the stone was not of uniform size, and that some of it had broken corners. . . . The stone was not of the quality called for by the specifications."

Owner Held Not Liable for Payment of Material

It is important to know that, although an owner and a contractor sign a contract which contains a clause obligating the contractor to furnish a bond, the owner does not increase his liability to material men by failure to demand the contractor to furnish the bond.

For illustration, in American Co. v. Ratliff's Metal Works, 125 So. 249, it was disclosed that an owner and a contractor entered into a contract by the terms of which the latter agreed to erect a building and furnish all the labor and materials for $10,500. The contract contained a clause, as follows:

"It is further agreed that the contractor shall furnish bond to the owner in an amount equal to the contract price of said building, which said bond is to protect the owner hereof against any and all claims that may arise against the contractor or against the building in any manner whatsoever."

The owner neglected to have the contractor furnish the bond and the contractor purchased all materials, including rock, sand, gravel, cement, marble and tiling, which he used in constructing the building. However, before he completed the work he realized that he had agreed to perform the work at a price too low to net profits and he abandoned the work without paying the material men. The latter filed suit against the owner contending that he was personally responsible for the payment for the materials used in the construction work, primarily because they had read the contract which contained a clause obligating the contractor to furnish bond and believed that the contractor had furnished the bond. However, it is interesting to observe that the court held the owner not liable, saying:

"There is no evidence in this record that McDavitt (contractor) made any representation that the bond provided for in the contract had been executed to any one of the parties, nor is there evidence that the American Co. made any representations with reference to the bond. . . . They (material men) were put upon notice by the terms of the contract that the American Co. had contracted against any liability. If they were depending upon the bond, it was their duty to make inquiry, as the American Co. was under no duty to inform the material men in this case that it had waived that part of the contract with reference to a bond; nor was it under duty to notify the material men that no bond had been executed by McDavitt (contractor). The material in this case was furnished and credit extended at a time when they knew that he was engaged in the performance of this contract."

When Mortgage Is Prior to the Mechanic's Lien

Since considerable litigation arises between contractors and holders of mortgages on newly constructed property, the recent case of Brush v. E. R. Bohan & Co., 283 Pac. 126, explains an unusually interesting point of the law.

In this case the owner of a lot mortgaged it for $10,000. The mortgage was properly recorded. Soon afterwards the owner purchased building materials such as cement, rock, plaster, sand, gravel and stone. Before the building was completed the owner abandoned the work and the mortgagee foreclosed the mortgage. The materialman filed a mechanic's lien on the contention that the mortgagee became the owner of the property after the foreclosure proceedings and, therefore, since the materials were used in the construction of the building the owner should be responsible for payment of the materials used therein, notwithstanding the fact that the mortgage was recorded before the first materials were delivered on the grounds. However, the Court held the mortgage superior to the mechanic's lien, and said:

"If recorded before any work is done or materials are commenced to be furnished, a trust deed is in the ordinary course of things prior to mechanics' liens. . . . The building placed upon the land became a part thereof and belongs to the owner of the land."

Insurance Problems Discussed

Legal Liability

Chickens, a few years ago, became an important factor in the operation of a certain stone quarry. This plant used dynamite in the ordinary course of its work. A farmer located a mile away brought suit against the quarry owner, alleging that the vibrations from blasting were killing his chickens. The suit became a serious matter because being in the center of a farming district, this producer could ill afford to establish a precedent of paying for dead birds.

This odd incident points to the fact that manufacturers and producers of material are responsible to the public for safety of the life and property of others. This fundamental law is generally known, but the appreciation of it as a problem of business varies according to the amount of traffic entering the plant. If your plant is situated in or adjoining a large city, you probably already carry public-liability insurance to protect yourself against this risk. In that case the main service of this article to you will be to emphasize the correctness of your judgment in providing this protection and to make clear some technical points in connection with it. If your plant is away from the great centers of population, it may be that you have never heard a full presentation of this particular business hazard.

Who Is the Public?

It is not uncommon to hear a producer explain, "Of course, I carry workmen's compensation insurance to take care of my employees, but I do not need public-liability insurance because outsiders are not allowed in my plant." By "outsiders" such a man is usually thinking of trespassers and visitors. Stop for a moment, however, and count how many outsiders come on your premises in the normal course of business: truck drivers, messengers, postmen, salesmen, inspectors, auditors, or employees of contractors working for you. You cannot avoid assuming liability for the safety of these people. Whether you wish to or not, you do not tell a man that he enters at his own risk. Unless you actually order him off your premises, the granting of permission to stay constitutes an implied invitation and makes you responsible for accidents that may occur. Even a salesman whom you do not want to see has a possible claim against you as long as he remains on your premises with permission.

Common Law Governs

The law governing public liability is altogether different from that which governs employees. Practically every state in the Union has a workmen's compensation act which limits what an employer must pay out and defines the injured worker's rights. But, if anyone other than an employee is injured, he may go after anything he can collect. His rights go back to the old common law, which says, in principle, that you are liable for damages in case anyone is injured through the negligence of yourself or your employees.

This means that, whenever an outsider is injured in an industrial plant, two successive questions must be considered. First, was the accident the fault of the injured man himself? Usually it is not. Such things as loose hand rails and floor boards, protruding nail heads, unguarded shaft openings and unlighted passageways are common causes of accidents where the proprietor is clearly liable for negligence. Secondly, what was the extent of the damages? In plain language, how much can the injured person collect? These are questions of fact or personal opinion. If they get into court, therefore, they are decided by a jury, not by a judge. With the well-known uncertainties of jury verdicts, it is almost always important for the business man to keep his troubles out of court. With a public-liability insurance policy there is very little risk of a law suit, because it is the regular program of the big insurance companies to settle by private negotiation or compromise both the question of who caused an accident and the extent of damages.

Employees of Others

A third question which occasionally complicates an injury case is the status of some persons who may be regarded as either employees or public. If you hire a laborer for a week, he is clearly an employee and subject to the workmen's compensation law. If you make a contract with a painter to paint an entire building for a fixed price and one of his men is injured on the job, you are liable to him as an outsider, that is, only if the accident be due to your negligence.

But how would you decide a case like this? A man was hired to chop down a tree. In the middle of his job he stopped for a drink. On his return he did not notice that someone had strung up a wire near him. As he swung his axe around it struck the wire and glanced off, hitting him in the face. Now, was this man an employee or was he an "independent contractor" who undertook a specific job? If he was an employee he would be taken care of under the workmen's compensation law. But if he was an independent contractor he could probably collect much heavier damages under the common law. The only practical solution of this and other borderline problems is to carry both workmen's compensation and public-liability policies in the same insurance company, so that it is incumbent on the insurer to work out the legal complications and protect you from all angles.

Limits of Policy

The size of policy to be bought is one of the practical questions in connection with public-liability insurance. When you buy workmen's compensation insurance, your policy gives you complete coverage under the statutes of your state. When you buy fire or windstorm insurance, you choose an amount which represents, closely, the full value of your physical property. But when you buy public-liability insurance, you get a policy which, in case anyone other than an employee is injured on your premises, defrays the full legal expense of adjusting the claim and pays damages up to the limit named in the policy. There is no unlimited policy; every one must name some figure above which the insurer will not pay, although this limit may be raised to any reasonable amount.

For example, I have never heard of a judgment for personal injuries exceeding $65,000. Since public-liability rates are much cheaper than those for workmen's compensation, you can get a $100,000 policy at a moderate cost which for all practical purposes is full coverage. The size of policy you choose will depend on your personal opinion of how prosperous you would look in front of a jury. In any case you should not consider policy limits of less than $10,000 per person and $20,000 if more than one is injured in the same accident (popularly called 10/20 limits). If you are well-to-do, or if your business is a partnership or corporation, higher limits than this are safer.

Elevator Accidents

The general public-liability policy, which covers ordinary accidents around your office or plant, does not cover accidents caused by automobiles, teams or elevators, or those resulting from the use of a defective product which you may supply. These risks may be covered under separate policies. The reason for separating them is that these features vary considerably from one plant to another, and it is fairer to fix rates and policies according to individual needs. You should bear in mind this division of coverage, however, to make sure that your insurance program does not omit some essential protection.

New Machinery and Supplies

Novel Clamshell Bucket Has Many Improvements

The new "Champion" bucket manufactured by the G. H. Williams Co., Erie, Pa., is said to possess more than 21 improvements in the construction of buckets designed for heavy duty.

The use of cast steel and rolled steel parts gives rigidity and strength

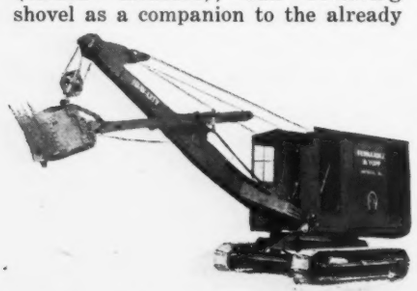
New type clam-shell bucket.

to bear the twisting strains of hard digging.

Some of the principal features include the shape of the scoop, which has been designed to operate through the path of least resistance, one piece, full-width main hinge, and all joints welded to eliminate obstructions to catch the material.

An 18-Ton Power Shovel With Five Combinations

Bay City Shovels, Inc., announces the Bay City K-2, full half-yard (struck measure), full revolving shovel as a companion to the already



New 18-ton shovel on crawlers.

popular Model K, light, half-yard, full revolving convertible shovel.

All of the features of design which have made this machine popular are offered in the K-2, the principal difference between these machines being the cubical contents of bucket, length of shovel boom and complete working weight of the machines.

Model K-2 has a working weight of 18 tons as shovel, is equipped with a half-yard struck measure bucket with manganese front and reversible teeth, 18-ft. shovel boom with 12½-ft. dipper sticks, and chain type crowd.

The weight is 18 tons compared with 14½ tons for the Model K. Crawler treads are 16 in. wide and the overall width of the machine has been increased to 8 ft. 4 in. as compared with 8 ft. for Model K. The overall length is 9 in. greater.

The same features and design are used on both models including 8 in. center pin, 71-in. diameter swing roller path, unit cast car body and unit cast machinery frame. Frictionless ball or roller bearings are used on all machine shafts, and steering and propelling clutches will continue to be located inside the cab with no parts under the car requiring attention or adjustment. The patented propelling feature permitting this machine to steer through independent reversible clutches for each crawler, allowing sharp turns to be made by running crawlers in opposite directions at the same time independently of each other, is continued on this model.

In addition to the shovel attachment, the Model K-2 is also available with clamshell, dragline, skimmer, trench hoe and crane attachments. It is simply a larger and heavier machine for contractors requiring increased bucket capacities and greater working ranges than have been available on Model K.

Pendulum Suspension On Four Rear Wheels

Relay Motors Corp., Lima, O., announces two new 6-wheeled models of the 2-wheel drive type, in which the Relay "pendulum suspension" has been incorporated on all four rear wheels. These wheeled units have been developed primarily for highway freight operation.

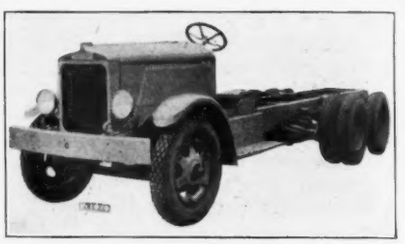
A basic feature of the suspension is the fact that the upward swing of the load automatically increases the downward pressure on the wheels, greatly increasing the traction.

The engine on both models is a 6-cylinder, removable L-head type. The 50SW engine has a bore of 3¾ in. and a stroke of 5 in., while the 60SW engine has a bore of 4⅛ in. and a stroke of 5⅛ in. Three-point suspension and forced-feed lubrication to all crankshaft, camshaft, and connecting-rod bearings is offered in both models. The 50SW engine has an S. A. E. rating of 33.75 hp. and the 60SW a rating of 40.8.

There are 456 sq. in. of driving surface on the multiple dry-disk clutch of the 60SW, while the 50SW has a driving surface of 336 sq. in. The transmission is of the selective-gear type mounted in unit with the clutch. There are five forward and two reverse speeds. A pad is provided for power take-off.

The front axle of both models is of the reverse-Elliott type, drop-forged I-beam section, one-piece construction, with tapered roller bearings in the hubs. The driving and trailing rear axles, which are flexibly connected, are of the oscillating type. The distance between the driving and trailing axles on the 50SW is 52 in. and on the 60SW, 54 in.

There are two complete sets of brakes on each model operating independently. Service brakes are of



Truck with cantilever spring rear axle.

the Lockheed hydraulic type, internal-expanding, operating on all six wheels; the hand brake is of the external-contracting type and acts on the propeller shaft.

The Relay 6-Wheeler uses a single spring on both rear axles. One end of this spring is directly connected to the frame by means of a spring shackle, while the other end is attached to the trailing axle by means of an oscillating rocker-arm construction which permits it to work as a cantilever spring.

Quartz-Rod Thermostat Controls Melting Pots

The General Electric Co. announces a quartz-rod thermostat for controlling the temperature of soft metal melting pots for use with lead, tin, babbitt, solder, etc. It is an inexpensive device with a high degree of accuracy.

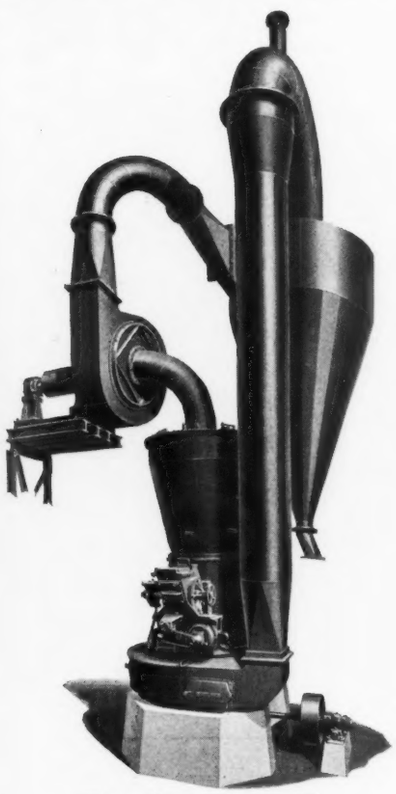
The thermostat consists of an enclosed switch and a nickel-chrome iron tube extending from its base and surrounding a steel piston and quartz rod. The thermostat has a temperature range of 450-950 deg. F. and will control temperatures to within plus or minus 14 deg. F. of its setting. The contacts are designed to carry any current necessary to operate any standard automatic control panel.

Midget Roller Mill Has Positive Feeding Device

The Raymond Bros. Impact Pulverizer Co., Chicago, Ill., has recently placed a small pulverizing unit of the roller-mill type on the market.

The Raymond midget mill is particularly adaptable for pulverizing chemicals, dry colors, dyestuffs, clays, limestone, talc and similar products at rates of capacity from 500 to 2,000 lb. per hour.

A positive feed device is provided and attached thereto is a pneumatic



The midget roller mill.

feed control which automatically governs the flow of material to the mill, as it is being ground, thereby maintaining a full load on the machine at all times. The journals are of the oil-lubrication type, which consumes but little oil and attention not oftener than at intervals of from 48 to 60 hours.

Small Space Is Required by New Fuel Economizer

Combustion Engineering Corp. has recently placed on the market the fin-tube type C-E Economizer.

This economizer can be installed in considerably less than half the space required for a straight, plain-tube economizer of equivalent heating surface. The principal features are the external return bends, the internal return bends, the tube arrangement and the use of finned tubes which provide additional heat-absorbing surface.

The heat-absorbing elements are constructed by connecting a U-bend to two straight tubes and so forming a U-tube. The open ends of each U-tube are connected serially by return bends located outside the end-plates, to the tubes directly above and below. The adjacent vertical tube sections are arranged so that the open ends of the U-tubes alternately enter one end and the other of the economizer casing. The water circulation is separated into two circuits, one running through the U-tubes connected by the return bends at one end of the economizer and the other through the U-tubes connected by return bends at the opposite end. A distinct advantage of the two separate water circuits is that the water flows through only one-half the tube distance as compared with the plain-tube, single-circuit type of economizer. With extended surface in the form of fins, the tube length is still further reduced resulting in such a decrease in the frictional resistance that the water pressure drop is about one-fifth that of the plain-tube, single-circuit type of economizer. Both circuits are served by common inlet and outlet headers.

The compactness of the unit is derived principally from the fin-tube design which reduces the tube-length per square foot of heating surface, and the return band arrangement which permits the tubes to be nested closely together so that the space they occupy is less than half the space required for a straight tube economizer of equal heat-absorbing surface. The end plates are designed to permit them to be quickly and easily removed for the inspection and cleaning of the tubes.

Auxiliary Power Shovel Attachable to Tractors

A new piece of equipment produced by The Miami Trailer-Scraper Co., Troy, O., is the Miami front-end shovel for Caterpillar tractors, Models 10, 15 and 20. This shovel is manufactured in both low and high-lift models, the low lift having a dumping clearance of 30 in., while the high lift has a dumping clearance of 6 ft.

The low-lift shovel is manufactured especially for the quick economical movement of loads of materials short distances. The high-lift model is used extensively in the loading into trucks or bins.

The Miami shovel is furnished complete, as illustrated, no extra tractor parts being required in setting up. It has a capacity of 8 to 9 cu. ft. for the Model 10, ½ cu. yd. for the Model 15 and ¾ cu. yd. for the Model 20.

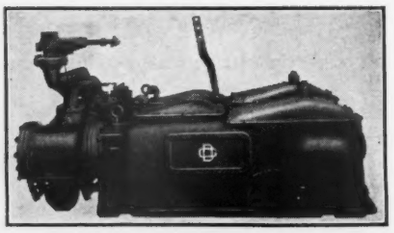
The shovel is constructed of high carbon plate, strongly reinforced by angle irons. The overhead cable carrying frame is hinged to the tractor treads to equalize the treads in operation. The operating cable provides for an equal lift on each side arm. A short-circuiting device is provided so that the shovel may not be raised beyond a stated maximum height. The shovel bucket is dumped by means of a dumping lever and rope, the shovel then being righted to its original position by a righting lever and rope.

Designs Roller-Bearing Rotary Drilling Engine

One of the latest products developed by the Quincy, Ill., plant of the Gardner-Denver Co. is a 12-in. by 12-in. twin roller-bearing rotary drilling engine designed to operate with 350 lb. of steam pressure. It is to be known as model DEB. The engine is 9 ft. ½ in. long and has a width of 6 ft. 5 in. The height of the engine proper is 3 ft., 11⅝ in., with an overall height of 4 ft. 7¾ in. It is designed and constructed to be light and compact for its high steam pressure of 350 lb. Total weight of the engine installed is 14,000 lb.

A dirt-proof case of strong semi-steel encloses all moving parts, such as cranks, eccentrics, valve rods and links. Dust-proof covers on top and hand holes inside of the case provide access to the interior. The base is cast integrally with the case, and rigidity is added to the mountings by means of toepads at the crank ends. The steam end is of special analysis semi-steel.

Power shovel attached to tractor.



Twin rotary drilling engine.

The crankshaft, measuring 6½ in. in diameter, is made from a special alloy-steel forging, ground to size. It is mounted in heavy-duty roller bearings supported by pedestals cast in the base. The bearing mountings are designed to take care of shaft expansion by allowing one end of the shaft to be stationary and the other to float. Cranks are set on quarters to eliminate the possibility of the engine stopping on dead center.

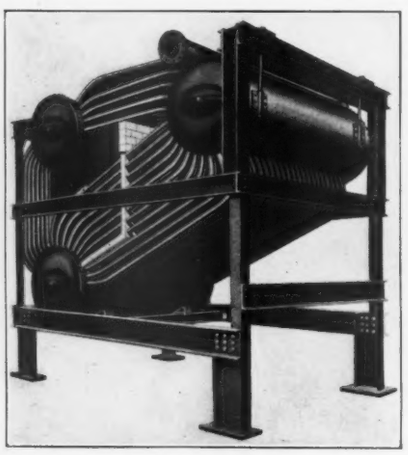
The moving parts are counter-balanced. The reciprocating parts are made as light as possible. This enables the inertia of the system to be reduced to a point that allows rapid acceleration either from rest or when direction of drive is reversed. Valves also are balanced to enable the movement to be frictionless.

All moving parts are lubricated by means of a splash system from the oil bath in the base. A pressure greased system lubricates the totally-enclosed main bearings. A mechanical lubricator oils the steam end proper.

Drum Type of Boiler Is Offered Smaller Plants

Of interest to the small and medium-sized steam user is the new "C" series of 3-drum boilers recently developed by the Erie City Iron Works of Erie, Pa. It is available in a wide range of sizes from 80 hp. up for steam working pressure up to 350 lb.

The design is an adaptation of the 3-drum boiler introduced to the trade several years ago by this company. It embodies most of the features of this early product, yet has been refined in many details of manufacture to provide an economical unit where space is an important consideration.



Three-drum boiler.

The quality of producing slightly superheated steam, a feature of their early 3-drum boiler, is retained in this low headroom boiler by the use of a horizontal steam header or manifold which, as shown in the illustration, is connected to the rear steam drum by a number of superheating tubes. Slightly superheated steam is discharged into the main steam line horizontally from the end of this header, an arrangement that reduces the headroom considerably over that required for the conventional top steam outlet.

Another interesting innovation is the elimination of the customary rear brick wall and the substitution of well insulated removable plates. An arrangement of baffles is used, which deflect the hot gases over every inch of heating surface in the boiler, thus gradually lowering their temperature until, in the last pass, an insulated steel plate rear wall is entirely adequate and obviously a great economy. Easy and quick access can be had to the entire rear of the boiler by removing these plates.

Further to reduce the cost of installing one of these boilers, many of the smaller sizes are designed to be shipped as a complete unit by removing the four short detachable legs.

Series "C" is adaptable to all firing methods. A booklet describing this boiler and giving its specifications is available and will be gladly forwarded by the above concern to anyone interested.

Toledo Announces Scale For Cement-Bag Filling

A new scale for use in filling bags to any predetermined weight is announced by the Toledo Scale Co. The device has been designed with profit-producing features to fill well known needs in this industry.

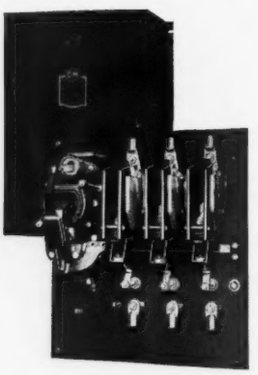
Levers are above the floor and the supply gate, so that overflow or spillage will not fall on pivots, bearings, and levers and cause inaccurate weighing. The dust-proof dial housing is important in a scale used in dusty locations. Moulded rubber gaskets and an exclusive oil seal prevent collection of dust in the sensitive head mechanism. A large 20-in. dial provides wide graduations and large figures, facilitating accuracy and speed in reading.

The scale is available with a predetermined weight head for operations where it is desirable to weigh to a single mark.

New Heavy-Duty A. C. Control Motor Switches

Two new magnetic contactors, for heavy-duty a.c. service, are announced by Cutler-Hammer, Inc., Milwaukee, Wis. They are rated for maximum capacities of 300 and 600 amperes respectively. The 300-ampere size is illustrated.

Features of these new contactors make them generally applicable to all heavy-duty requirements. They are arranged for either two- or three-wire control, have continuous duty operating coils, highly efficient magnet structure, and exceptionally heavy, butt type, solid copper contacts. An air cushion absorbs the shock of the magnet on closing, thus reducing wear and making the contactor operate more quietly. For general use, the 300-ampere contactor is mounted in a wall-type enclosure, and the 600-ampere size is in a floor-type case.



New magnetic contactor.

Canadian Firm Installs Shovel in Gypsum Mine

The recent installation of a Goodman Mfg. Co. type 48 power shovel in the gypsum mine of Gypsum, Lime & Alabastine, Canada, Ltd., at Caledonia, Ont., is an interesting development in the non-metallic mineral industries. Power shovels are used in numerous limestone mines in which there is abundance of headroom but heretofore they have not been used in such comparatively low underground workings as prevail in most gypsum mines.

The Goodman shovel was developed for service in coal mines in which headroom is generally restricted, and it has given complete satisfaction in that field for a number of years. The accompanying views show this machine in the Caledonia gypsum mine working a 7-ft. vertical face. Each room is carried this height for an average advance of 300 ft. and a width of 22 ft. On the return, the pillars between rooms are further removed and an additional 4 ft. of gypsum worked from the roof.

Power shovel loading gypsum into a mine car.

The formation is practically level, at an average depth of 80 ft. from the ground's surface. The mine's mouth is a slope. Cars are hauled to and from the foot of the slope by mules on 32-in.-gauge track. Each car is 10 ft. long, 36 in. high, and 40 in. wide, and its average load is 3 tons, or about 4 scoopfuls of the shovel.

This is called an electro-hydraulic type of shovel. It travels on chain treads and is securely anchored at any place in the mine by the vertical hydraulic jack which is forced upward against the roof. All power is supplied by one 22-hp. compound-wound electric motor. The travel of the machine and the swing of the scoop are produced directly from the motor, but hydraulic operation features not only the jack but the various movements—forward and back, upward and downward—of the scoop, and the travel of the ejector or that member of the machine which empties the scoop. The machine has a full 360-deg. range of swing. It can operate under a 6-ft. roof.

Water for the hydraulic operations is pumped from the tank behind the operator and returns to the same tank, being used repeatedly. The shovel exerts a 6-ton thrust into and under the rock, and it can lift a 3-ton load when fully extended. This remarkable power has been utilized at times in numerous unusual functions, such as rerailing cars, gently but forcefully pushing a loaded car, or removing mine props.

Power shovel, scoop being thrust under broken rock.

Booklet on Wheelbarrow Standardization Issued

The Division of Simplified Practice of the U. S. Bureau of Standards, Department of Commerce, has announced the availability of Simplified Practice Recommendation No. 105—Wheelbarrows, in booklet form.

The action taken by the industry in effecting this simplification has resulted in the reduction of the number of sizes and varieties of wheelbarrows from 125 to 41—or 67 per cent.

Copies may be obtained from the Government Printing Office, Washington, D. C., for 10 cents each.

Birmingham Distributor Appointed by Trackson

Trackson Co., Milwaukee, Wis., announces the appointment of the Millsap Road Machinery Co., 23rd St. and 23rd Ave., Birmingham, Ala., as a new distributor of Trackson tractor equipment in the Birmingham territory.

This company will handle a complete line of Trackson crawlers, shovels, loaders, cranes, hoists, etc., and will be able to give prompt service on orders for these machines as well as for repair and replacement parts.

New Corporations

McNeff Sand Co., Hyndsdale, Martinsville P. O., Ind. To produce silica sand on land leased from Hewitt farm. Miss Laura McNeff, pres.; Mrs. Lee McNeff, vice-pres.; Lee McNeff, sec.-treas.

Colgan Ready-Mix Concrete & Sand Corp., 201 Ocean Ave., Brooklyn, N. Y. George A. Colgan, Sr.; George A. Colgan, Jr.; Frank G. Colgan. 50,000 shares n.p.v.

Trap Rock, Ltd., Bruce Mines, Ont., Can. $20,000 pfd.; 40,000 shares com. n.p.v.

Fulton County Stone Corp., Gloversville, N. Y. $40,000. Morrell Vrooman, pres.; Joseph Sandfordt, vice-pres.-sec.; George M. Naigney, treas. To operate quarry at Mayfield, N. Y.

Renton Sand & Gravel Co., Renton, Wash. G. A. Harner, Ethan Allen Peyser. $15,000.

Oceanside Rock & Sand Co., Carlsbad, Cal. R. W. Baird and C. M. Davy, Carlsbad; J. R. Wotring, Long Beach. $125,000.

Babylon Sand & Gravel Co., Babylon, N. Y. A. S. Smith, 70 Wall St., New York City. $100,000 pfd.; 10,000 shares com.

McKay Sand & Gravel Co., Eugene, Ore. J. T. McKay, H. B. Ruth, Howard Platt. $10,000.

Three Man Gravel Plant Co., Inc., Bienville Hotel, New Orleans, La. A. D. Alderson. $16,000.

Reliable Sand & Gravel Co., First Nat. Bank Bldg., Canton, Ohio. James L. Amerman. $5,000.

Contractors' Sand, Gravel & Supply Co., 212 Hazen Bldg., Cincinnati, Ohio. Pinckney Brewer, pres.; Joseph A. Byrnes, vice-pres.; Clarence Murdock, sec.-treas.; Alfred F. Deckebach, gen. agt.; Philip Freshwater, Michael Hannon, all of Cincinnati. To develop sand and gravel pit at Newtown, Ohio. $100,000.

Watauga Stone Co., Watauga, Tenn. Howard Young, pres.; Robert S. Campbell, vice-pres.; Henry McCroskey, treas.; Charles M. Seymour, sec. Crushed limestone quarry to be developed at Watauga, and river sand pit at Siam, Elizabethton P. O., Tenn. $250,000.

Chester Granite Quarries, Inc., Chester, Mass. F. P. Wagner, pres.; Edward M. Nolan, vice-pres.; John J. Lester, treas., 64 Oak Grove Ave., Springfield, Mass. $200,000.

Blanco River Gravel Co., San Marcos, Tex. T. E. Lilly, M. J. McDaniels, Dallas. $25,000.

Stephens-Adamson Moves New York Sales Office

The Stephens-Adamson Mfg. Co., Aurora, Ill., engineers and manufacturers of conveying and elevating machinery, announces the removal of its New York sales and engineering office to Room 1360, 50 Church St.

Manufacturers' Publications

Each publication listed below contains information of interest to non-metallic mineral producers. Readers may obtain, without charge—except where a price may be stated—and without obligation, copies of any of these publications by writing directly to the manufacturers who publish them. Please mention PIT AND QUARRY *when writing.*

Boilers

Griscom-Russell Evaporators. 35 p., 63 ill. Bulletin 361. (Griscom-Russell Co., 285 Madison Ave., New York, N. Y.) This bulletin fully discusses the functions, applications and advantages of evaporators for distilling boiler-feed make-up water and a new reducing valve evaporator system for economical application of evaporators to industrial plants requiring considerable steam for process work.

Cable

The Hercules Record. 15 p., 8 ill. (A. Leschen & Sons Rope Co., St. Louis, Mo.) Describes application of steel cable to aerial tramway. New dam on Ouachita River for 200,000-hp. hydro-electric plant of the Arkansas Power and Light Co., etc.

Cement

Besser Tampings. 4 p., 9 ill. (Besser Manufacturing Co., Alpena, Mich.) Describes and illustrates machinery designed to improve the appearance of concrete blocks.

Bulletin 180. 16 p., 23 ill. (Butler Bin Co., Waukesha, Wis.) Describing cement mixing while in transit. *Bulletin* 190. 16 p., 21 ill. (Same company.) Describes concrete plants for wet batch method.

Conveyors

Catalog 202. 71 p., 149 ill. (Chain Belt Co., Milwaukee, Wis.) Complete description of the Chain Belt Co.'s machinery for the handling of bulk materials.

Drying and Dust Recovery

Bulletin 30. 5 p., 8 ill. (Dust Recovering & Conveying Co., Cleveland, O.) Descriptive of an improved system for spray drying and recovery of product.

Electrical Devices

Bulletin 1047-*A*. 11 p., 16 ill. (The Electric Controller & Mfg. Co., Cleveland, O.) Describes 2,300-v. automatic compensators for a.c. squirrel cage and synchronous motors. *Bulletin* 920. 23 p., 53 ill. (Same company.) Describes time-current control for a.c. motors.

Explosives

The du Pont Magazine. June, 1930. (E. I. du pont de Nemours & Co., Wilmington, Del.) A number of interesting articles dealing with their products.

Machinery

Bulletin AC. 97 p., 98 ill. (Sterling Machinery Corp., Kansas City, Mo.) Describes and illustrates their line of air compressors, mine hoists, gas and electric pumps and special equipment.

Catalog. Section B. 123. 96 p., 44 ill. (Sprout Waldron & Co., Muncy, Pa.) Describes a line of ball-bearing sieve bolters and reels. *Catalog Section F.* 129. 68 p., 109 ill. (Same company.) Describes a line of mixing and blending machinery.

Pavements

Pavements for Modern Traffic. 27 p., 66 ill. (Portland Cement Assn., Chicago, Ill.) A very attractive presentation of concrete paving practice embodying a complete discussion of many ideas and methods of interest to persons in and out of the concrete paving field.

Sand

The Silica Sands of Ottawa. 69 pages, profusely illustrated, dealing with "The Romance of a Great American Institution and Its Footprints on the Industrial Sands of Time." Very instructive. (The Ottawa Silica Co., Ottawa, Ill.)

Tools

Bulletin 865. 11 p., 18 ill. C. P. Demolition Tools and Sheeting Drivers. (Chicago Pneumatic Tool Co., Chicago, Ill.)

Clay Producers to Meet on July 16 at New York

Clay producers of the country are invited to attend a meeting July 16, 1930, at 10:30 a. m. in the New York Athletic Club, looking to the organization of an association which will be along the same general lines as those followed by the Feldspar Grinders' Institute. Particulars may be had by addressing W. J. Parker, 7 East 44th St., New York, N. Y.

Ormrod, Pa., Cement Mill Rededicates Its Trophy

The Lehigh Portland Cement Co. held a unique celebration June 18, 1930, at Ormrod, Pa. The occasion was the re-dedication of the Portland Cement Association's trophy that was awarded to Mill No. 3, and the dedication of the similar trophy that was awarded to Mill No. 2.

Lt.-Col. H. A. Reninger presided at the ceremony which included the following program:

Music, Klinger's Municipal Band.
Prayer, Rev. Simon Sipple, D. D.
"America," sung by Ormrod school children.
Presentation of trophy, J. B. John, chairman, Accident Prevention Committee, Portland Cement Assn.
Unveiling: Mill D, by Marjorie Miller, Pauline Lobach. Mill F, by Marie Helfrich, Dorothy Laub.
Acceptance of trophy, W. J. Montz, superintendent.
Address, Col. E. M. Young, president.
Recitation, "Safety First," by seven girls and four boys.
Address, E. C. Spring.
Song, by assemblage.
Recitation, "Our Safety Banner," Master William C. Semmel.
"Star Spangled Banner," sung by assemblage.
Benediction, Rev. Simon Sipple.

Refreshments and more band music concluded the celebration.

Concrete Highways Show Expected Gain for 1930

Building of paved roads is proceeding faster than ever before, according to William M. Kinney, general manager of the Portland Cement association.

Mr. Kinney states that although fewer streets and alleys are being paved as yet, the contracts awarded for concrete rural roads have been great enough to bring the total awards for all concrete pavements to more than 64,666,000 sq. yd. for the first five months of the year. This is a gain of one-eighth over the same period in 1929.

Insofar as hard surfacing is concerned, 1930 is likely to set a new world's record in road building, Mr. Kinney asserts.

New Dolomite Workings Are Under Construction

The Tennessee Coal, Iron & Railroad Co., Birmingham, Ala., is building a new and modern dolomite plant, and opening a new quarry at Dolonah, 20 miles north of Birmingham. This will replace the present plant and quarry at Ketona. The stone will be used for open-hearth fluxing.

The plant was designed by the company's engineers and is of all-steel construction with concrete footings. Loading in the quarry will be done with a steam shovel. A skip hoist will take the stone to the top of the plant where it will be crushed, screened and washed. Operation will be begun early in 1931.

Prest-O-Lite Opens New Factory in Atlanta, Ga.

The Prest-O-Lite Co., Inc., 30 East 42nd St., New York, N. Y., announces the opening of a new plant for the manufacture of dissolved acetylene at 1240 Stewart Ave. S. W., Atlanta, Ga. The new plant is designed to take care of the demand occasioned by the increased use of the oxy-acetylene process in this industrial area. It is situated on a private siding of the Atlanta and West Point R. R.

With the opening of the new plant, the old plant at 345 Kuhrt St. S. W., Atlanta, will discontinue operations.

Unusual Sand-and-Gravel Equipment Employed in Constructing New Wyman Dam

THE Central Maine Power Co. has a dam under construction at Bingham, Me., which will require two years or more to complete. The location of the dam is such that it would cost too much money to bring the washed sand and gravel to its location from established sand-and-gravel pits. The engineers of the power company, after careful investigation, found a location suitable for the dam and a sufficient amount of sand and gravel close enough at hand to pay the power company to put in its own preparation plant. The sand and gravel deposits are several miles from the location of the dam and, to get the prepared materials from the sand-and-gravel deposit to the dam, a railroad was constructed at a considerable expenditure. Still a considerable saving was offered for the company to prepare its own material, construct the sand-and-gravel handling and washing plant, and the transportation facilities. The sand-and-gravel washing and storage plant presented quite a problem because it had to be written off the books in the two-years' period.

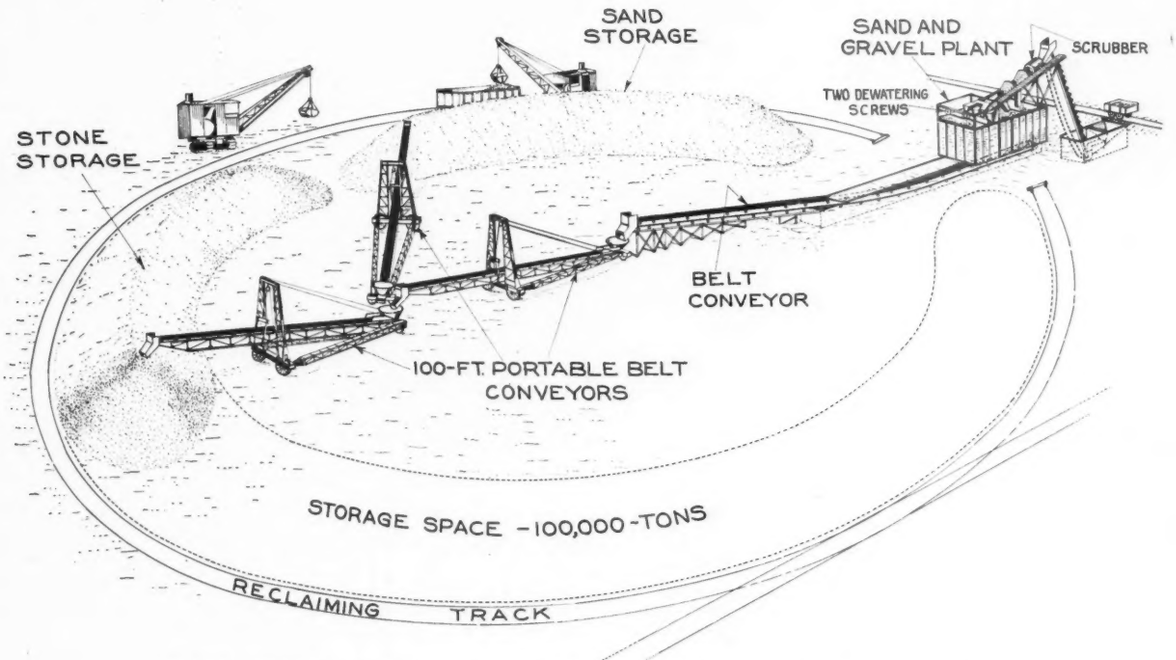
The building operations continued through the past winter season. As this dam is located high in the mountains, where the temperatures are exceptionally low, the preparation of the raw materials was discontinued during the winter. The handling plant, therefore, involved the feature of providing sufficient storage to carry the power company over this period of washing inactivity. The problem was solved in a very economical way.

The depth of the sand-and-gravel deposit over a given area does not exceed 10 ft. This material is taken from the deposit by means of gasoline-operated shovels and loaded into side-dump cars. These side-dump cars are hauled by a locomotive to a receiving hopper where the material is dumped through a bar grating. The material then passes a reciprocating feeder to a continuous-bucket elevator of the belt type. The capacity of this unit is 125 tons per hour and the material consists of 4-in. gravel and under, together with sand. Tests show that there is approximately twice as much gravel as sand. There is a small amount of loam in this product, so it is discharged from the elevator into a scrubber which, in turn, discharges to two Dull conical screens. These screens take the washed material and divide it into gravel 4-in. to 1¼-in., and gravel 1¼-in. to ⅜-in. Sand is the material ⅜-in. and under. Tests on the work have shown that, if the power company could obtain a little more of the fines in the sand, they would save considerable on the cement. The sand from the last Dull screen is washed over two Caldwell dewatering screws and the overflow from these dewatering screws is passed through a 60-in. Dull settling tank.

The separation of the various sizes of the gravel need not be perfect as the materials are not prepared for commercial purposes. The various sizes of materials from the separating units are deposited in small bins under the screens. The gravel is mixed when it finally is used in the dam.

The washer or scrubber is a cylindrical tank or shell with internal retaining rings dividing the length into various compartments which retard the progress of the material through the scrubber while lifting vanes raise and drop the material into a bath of water. By the washing and scouring action of the repeated lifting and dropping, carried forward in the various changes through the different compartments, the lumps of loam are reduced, and the impurities are separated from the sand and gravel, so that the material passes to the screen in proper condition for sizing and washing.

The scrubber and the screens are mounted on a single shaft. The conical screens are set on an incline, two in number in this particular case. These screens are efficient and conform to



Sketch of washing and storage layout, Central Maine Power Co. aggregates plant.

certain fundamental requirements and principles: first, the slope of the working portion of the screens is such as to assure proper speed of the material in its travel; second, the slope of the water pans beneath the screen is sufficient to enable the water to carry the material from screen to screen without clogging, yet no steeper than is necessary for this unit; third, the screens are driven by the least possible machinery, of utmost simplicity and free from contact with the materials, as the combination of water, sand and stone is extremely abrasive and hard on machinery.

The first Dull screen at the top of the incline receives the maximum of the material and has the larger holes. Therefore, the plates are heavier and more substantial. The sand and water is led to the dewatering screw, which consists of a screw conveyor mounted on pipes and set at a proper angle, to dewater and drain the sand as the screw tends to force the materials out of the water up the incline. The agitation from the slowly revolving screw is ample to wash the sand well and to drain it properly after the sand has been carried above the water level.

The washed sand and the two sizes of gravel are retained in the wooden bin beneath which has various gates for the control of the materials as they are withdrawn. A long belt conveyor receives the material and an attendant draws off the various kinds of materials, or mixes them, as may be required. This belt conveyor operates horizontally for part of its length and is inclined for the balance, bringing the discharge point above the surrounding ground level. From this belt conveyor, the materials are discharged to a portable belt conveyor on 100-ft. centers. This belt conveyor is mounted on radial wheels so that it can swing in an arc and distribute its load to the portable storage belt above mentioned conveyor. By this arrangement, the storage pile under the head of the final belt conveyor has a large radius and forms a very substantial pile. These final storage belt conveyors are so arranged that one is used for sand and the other for gravel.

The location of these portable conveyors is on high ground made by filling with washed sand and gravel. This acts as an additional reserve or extra storage. The base of the storage pile proper is 20 ft. below the level where the portable conveyors are kept. In this way, the portable belt conveyors form a pile approximately 40 ft. high and circular in shape with a radius of more than 200 ft., so this outside storage amounts to approximately 100,000 tons of washed material.

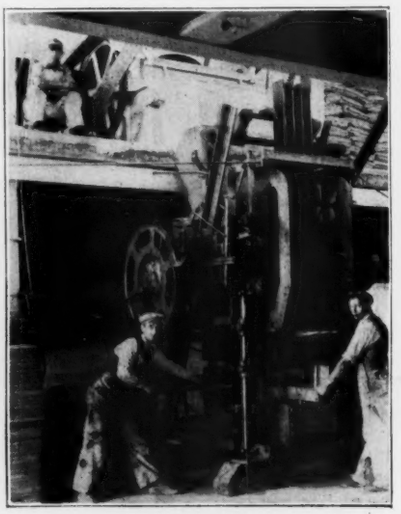
Outside of this entire storage space is a standard-gauge railroad track on which cars are run to receive the material from the storage pile, reclaimed by crawler cranes. Under the pile at one end is a tunnel into which the cars go for quick loading, the prepared material being overhead.

The initial excavation on taking the sand and gravel from the power company's deposit consisted of the sand and gravel that occupied the space where the washing plant and the inside area of the storage plant are now located. All materials are deposited in a pile of large dimension without any structure or support for the conveyors going into the pile itself. The plant is flexible, inexpensive in first cost and maintenance, and the washing and storage problem is proving satisfactory.

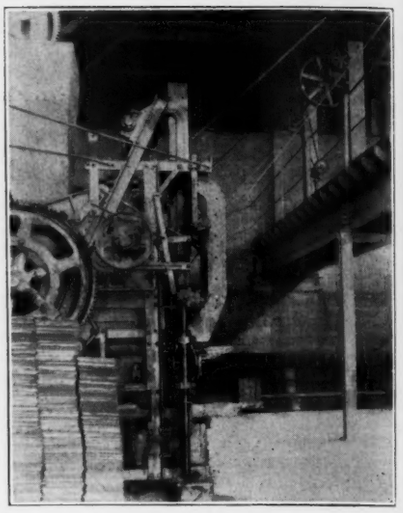
Waterproof Blocks Made from Pressed Concrete

That it is possible to employ concrete blocks successfully in the construction of waterproof tanks or bins is evident from the fact that such blocks were actually used to build a private swimming pool in Lehighton, Pa.

This pool was built under the supervision of Henry W. Mertz of the firm of Mertz & Miner, manufacturers of concrete products, Lehighton, Pa. The cement blocks used in the construction were taken from the regular stockpile of his factory. No waterproofing compound was used in the manufacture of the blocks nor was the pool itself coated with any cement mixture or waterproofing compound. The secret of the construction of this watertight cement-block pool is the use of a high-grade block and skillful masonry.



Automatic stripper making the blocks.



Side view of the stripper.

Some time ago Mertz & Miner had their blocks tested in the laboratories of Lafayette College, Easton, Pa., and the test showed that the blocks had more than double the necessary sustaining strength and were capable of carrying from 20 to 60 times the load ordinarily imposed in building construction. The chemist who tested the blocks at the Lafayette laboratories pronounced them the best ever tested by them.

Of course, it goes without saying that porous cement blocks of poor quality and unskilled workmanship would not give a watertight cement pool.

These blocks were made in a standard stripper furnished by the Besser Manufacturing Co., Alpena, Mich. This machine is entirely automatic and can make six 8-in. by 8-in. by 16-in. blocks or twelve slabs or tiles per min., the flat forms being pressed two at a time. Change in size is made quickly. The mold is lifted off the block automatically, the cores being supported at the top, and one-size pallets are used for all types and sizes of unit.

The Besser company manufactures batch concrete mixers, tampers, molds, brick machines, concrete-block cars, and various other kinds of equipment. The factory is operated as a one-unit control under the engineering and production officials. The engineering staff is always ready to cooperate with operators in designing and arranging equipment to fill special needs or to establish the most effective functioning of every detail. District sales offices are maintained in eight of the leading cities of the country. A little periodical known as *Besser Tampings* is devoted to matters of interest to manufacturers of concrete products and may be received upon request.

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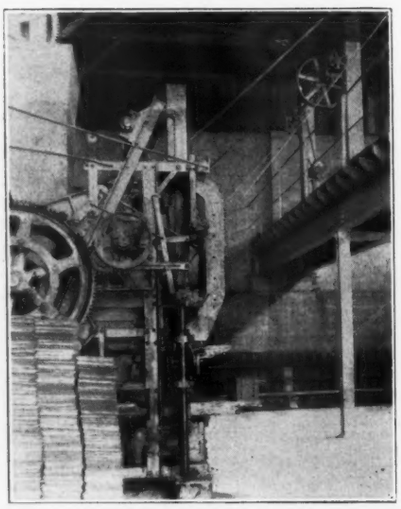

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BUILT from the business-end back

for taking rock as it comes

Whether you run into lots of oversize or whether the bank is well shot, a Bucyrus-Erie full revolving quarry shovel keeps things moving. There is little delay for secondary blasting—the oversize is moved behind and the shovel keeps right on digging.

These big output shovels make new speed and economy records wherever they dig. Years ago Bucyrus-Erie engineers set out to design a shovel for the hardest quarry digging. Let's take a look at it *from the business-end back*. A special rock dipper of the toughest alloy; shock-proof outside dipper handles of steel armored wood; deep box girder boom which, though of minimum weight, is built to withstand terrific strains.

And behind this business end, a single part twin hoist for the heaviest digging—main machinery of great ruggedness and simplicity. Crowd and swing machinery built for the hardest service—unit-cast steel construction—mountings that stand the gaff. Every inch quarry shovels built to handle any kind of rock.

2, 2½, 3, 4-yard—electric or steam—there's a Bucyrus-Erie quarry shovel that exactly fits your quarry. Write today for a description of the size you need.

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Pit and Quarry

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Read in Largest Number of Plants

Published Biweekly on Wednesday for Producers and Manufacturers of Sand, Gravel, Stone, Cement, Gypsum, Lime, and Other Non-Metallic Minerals.

Subscription price: $5 for 3 years, $2 for 1 year in the United States and possessions, North, Central and South America; elsewhere $1 additional for each year. Single copies 20c.

Entered as second-class matter October 9, 1928, at the Post Office at Chicago, Illinois, under the Act of March 3, 1879.

Published and copyrighted, 1930, by the

COMPLETE SERVICE PUBLISHING COMPANY
538 South Clark Street, Chicago, Illinois

H. W. BAUMGARTNER, *President* — V. E. LARSEN, *Vice-President*

S. A. PHILLIPS, *Directing Editor* — ARTHUR J. HOSKIN, *Editor*
W. E. TRAUFFER, *Assistant Editor* — G. B. MASSEY, *Associate Editor*
HARRY F. UTLEY, *Assistant Editor* — G. F. SONDRAKER, *Associate Editor*

New York Representatives:
E. M. BUCK, 68-43 Clyde St.; Telephone BOULEVARD 5259; Forest Hills, L. I., N. Y.
V. A. LESLIE, 301 W. 108th St.; Telephone ACADEMY 7990; New York, N. Y.
Cleveland Representative:
W. E. COATES, 2198 Elbur Road; Telephone BOULEVARD 0688 W; Lakewood, O.

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Pit and Quarry
With which is consolidated
CEMENT-MILL & QUARRY
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Wisconsin Firm Adds New Hydraulic Dredge

CAPACITY NOW 100 CARS DAILY

The Central Lime & Stone Co. of Afton, Wis., has completed and is putting into service its second hydraulic dredge for procuring sand and gravel. The combined capacity of the two dredges will be 100 to 110 carloads per day.

The company controls two distinct deposits, one running about 75 per cent gravel, the other about 65 per cent sand. The dredges are operated in the latter material. The older dredge contains a W. H. K. Bennett centrifugal pump driven by a 500-hp. Allis-Chalmers motor. A cutting chain is used around the suction head. The dredge is of timber construction, mounted on steel pontoons.

The new dredge was designed and built under the supervision of the company's superintendent, Floyd Tefft. It is considerably smaller than the old dredge in size and capacity. It contains an American Manganese Co. 8-in. centrifugal pump, driven by an Allis-Chalmers 150-hp. motor. An American Wells Wks. 2½-in. centrifugal pump with a Penberthy ejector is used to prime the main pump. The boom is powered by an American Hoist & Derrick Co. hoist. No cutting chain is used around the suction head. This dredge also is of timber construction with auxiliary steel-drum pontoons along the sides for stabilization. Its capacity is around 35 or 40 carloads per day, and its cost was about $8,000.

A new tipple has been built to handle the material from the new dredge. It is of timber construction, and was designed and built by the company's own men. Large revolving screens, located at the top, were also locally designed and built. These are driven by a Westinghouse 15-hp. motor through a Jones speed reducer. The graded gravel passes directly to a stock-pile below, while the sand passes to secondary screens and is separated into different grades which drop to respective piles beneath. The pump line from the dredge discharges directly into the revolving screen, a lift of about 60 ft. above the dredge level. The finished products are loaded directly from the stock-piles into cars by a clamshell derrick.

Material from the deposit that is chiefly gravel is handled by a dragline excavator and belt conveyors to the new tipple.

Formerly as many as sixteen men were required to excavate and convey materials to the screen, but with the new arrangement and equipment only two men are needed on each dredge.

Missouri Portland Picks Site of Plant at Tulsa

As announced in the June 18 issue of PIT AND QUARRY, the Missouri Portland Cement Co., of St. Louis, has selected Tulsa, Okla., as the site of its new wet-process cement plant. At that time, however, the exact location had not been definitely selected. During the dinner at the Mayo Hotel on June 27, where the Missouri Portland Cement Co. was host to many Tulsa citizens, Hiram Norcross, vice-president of the company announced that the new $2,500,000 plant was to be erected at Dawson, a suburb of Tulsa. It is not known when ground will be broken but Mr. Norcross stated that the plant would be in operation within twelve months.

Indiana Quarrymen May Build Own Power Plant

A proposed project by an association of the larger stone operators in the oolitic limestone belt near Bloomington, Ind., to build an electrical power plant is being examined by a group of engineers who are already at work compiling data on costs.

The decision by the quarrymen to manufacture their own power was brought about by the high rates charged by the local power company which has held to the present rates despite the fact that the quarries use about 40 per cent of the power consumed in the region.

Washington Talc-Mining Plant to Operate Soon

Operation by the Mac-Myrl Talc Mining Co. of its mine and plant on the Skagit River, near Marblemount, Wash., will begin shortly, it is reported. A railroad spur and warehouse are now under construction.

To Establish Granite Plant in Minnesota

FORM ARROWHEAD GRANITE CO.

Establishment of a granite-finishing, cutting and polishing plant at Virginia, Minn., which would lead to development of large granite deposits in St. Louis county and make Virginia the headquarters of a comparatively new industry, is proposed by a group of Virginia and Hibbing, Minn., business men now engaged in the preliminaries of organizing and financing the project, it is reported.

The firm is being incorporated under the laws of the state of Delaware and will be known as the Arrowhead Granite Co. The firm will assume the entire quarry and plant of the present Arrowhead Granite Co. of Minnesota, now operating two miles west of Cook, Minn., as well as several other tracts of granite deposits controlled by the old company.

Establishment of the plant will result in opening other prospective quarries in the district, the rough product of which would be finished at the Virginia plant, according to press reports.

California Silica Plant Soon on Full Schedule

The Silica Co. of California is now mining a high-grade silica sand from Mt. Diablo in Contra Costa County, Calif. This domestic product supplants silica formerly imported from Belgium. R. M. Greathouse, president and general manager of the company, states that the new plant, which commenced operations on July 1, will be running on full schedule in about two months.

Will Operate Municipal Crushing Plant in Maine

The J. W. Cummings Feldspar Co. has leased the municipal crushed-stone plant at Bath, Me. Under the terms of the lease, the company will furnish all the city's aggregate at a flat rate of $2.40 per ton and will dispose of the surplus to outside interests, the municipality to collect a royalty of 10 cents per ton on all material thus sold.

Construction in June Shows Huge Increase

BEST MONTH SINCE JULY, 1929

June contracts let for new building and engineering works in the 37 states east of the Rocky Mountains amounted to $600,573,400, according to F. W. Dodge Corp. The past month's record was substantially larger than the total of $457,416,000 for the previous month; showed a good gain over the total of $529,891,100 for June, 1929; and was the largest monthly total since July, 1929. For the first half of 1930, construction contracts aggregated $2,638,013,300. This was a decline of only 12½ per cent from the total of $3,015,546,800 for the corresponding period of 1929. At the end of May contracts for the year to date were 18 per cent behind last year.

For the sixth consecutive month public works and utilities were the most important of all classes. This construction type amounted to $251,915,800, or almost two-fifths of the value of all June awards. The following comprised the remainder: Residential buildings, $96,815,500; industrial buildings, $93,618,500; commercial buildings, $59,080,000; educational buildings, $48,918,800; hospitals and institutions, $19,675,300; religious and memorial buildings, $11,808,500; social and recreational buildings, $10,187,000; and public buildings, $8,554,000.

Contemplated new work reported in June amounted to $763,216,100, compared with $634,073,400 for June, 1929.

The table at the bottom of this page was compiled from figures supplied by the F. W. Dodge Corp. for the states and building areas east of the Rocky Mountains.

Fire Causes Damage at Pennsylvania Lime Plant

Two buildings, two automobile trucks, machinery and equipment were destroyed by fire recently at the plant of the Wernersville Lime & Stone Co. at Wernersville, Pa. The loss was approximately $10,000.

A large quantity of dynamite was stored in a building 150 feet distant from the structures in which the fire raged. Danger from this source was averted by streams of water and by the distance between the buildings. The large frame building destroyed was used as a storehouse for the trucks and a lot of equipment.

Davenport Firm Erecting Limestone Plant in Iowa

The Calcite Products Co., Davenport, Ia., is erecting a new limestone plant on a 233-acre deposit located nearby. The deposit, according to Wayne Bashaw, one of the officers of the company, lies in three distinct horizontal strata, each approximately 30 ft. in thickness. Machinery is about to be purchased and the organization is at present seeking an engineer to take charge of the project and become a permanent member of the organization.

New Equipment Added at Michigan Gravel Plant

New equipment, including bins, pumps, screens and a crusher, has recently been installed in the sand-and-gravel plant of the East Lansing Gravel Co., East Lansing, Mich. The company is a subsidiary of the Leonard Gravel Co. of Lansing, Mich.

Shawnee Stone Co. Gets Large Pittsburgh Award

The Shawnee Stone Company of Bloomington, Ind., has obtained one of the largest cut-stone contracts so far this year. It calls for 450 carloads to be used in construction of an office building for the Gulf Refining Co. in Pittsburgh, Pa.

Arrange Exhibits for World Road Congress

PRES. HOOVER MAY PARTICIPATE

Official delegates have been named thus far by 40 nations to attend the sessions of the Sixth International Road Congress and the exposition of road machinery and materials to be held by the American Road Builders' Association, at Washington, D. C., October 6 to 11, according to congress officials.

The congress sessions will have papers on the leading highway problems prepared by some of the best American authorities and probably will be participated in by President Hoover, members of his cabinet and many other dignitaries of national and international importance.

According to reservations for exhibits already received, the exposition will give a representative picture of the road building industry in the United States, according to Charles M. Upham, engineer-director of the Road Builders' organization, who is in charge of the exposition.

Both in the Washington Auditorium and the outdoor demonstrations, delegates will see the best equipment that America produces for road building. Scrapers, mixers, rollers, motors, tractors, surfacing machines, power shovels and smaller equipment as electric tools and ball and roller bearings will vie for attention with the exhibits of the material producers, such as concrete, asphalt, brick, iron, and steel reinforcing. Other exhibits will be office equipment for highway departments, traffic signals and signs, trade publications, literature, motion pictures and catalogs of manufacturers which will cover every phase of road machinery and materials.

During the entire week of the congress the exposition will be open daily.

BUILDING AND ENGINEERING CONTRACTS AWARDED DURING JUNE, 1930, BY TERRITORIES, EAST OF ROCKY MOUNTAINS

Territories	June, 1930, Building and Engineering Contracts Awarded	Per Cent Increase or Decrease, Compared with—		Contracts Awarded During Jan., Feb., Mar., Apr., May and June, 1930, and Per Cent, Increase or Decrease Compared with Same Period 1929		Distribution of June, 1930, Contract Awards				
		May, 1930	June, 1929			Residential	Commercial and Industrial	Public Works and Utilities	Educational	Contemplated Building Reported
New England States	$38,089,400	+ 4.3	+ 7.4	$183,495,500	− 13.3	$11,951,400	$ 4,207,100	$ 5,594,200	$11,770,000	$ 89,722,500
Metropolitan New York and vicinity	80,324,900	− 16.4	− 5.3	512,502,800	− 13.7	21,003,600	21,837,800	25,470,400	7,459,900	94,712,400
Up-state New York	21,456,900	− 12.3	− 6.5	101,843,200	+ 7.7	3,547,800	3,611,600	6,921,000	4,389,300	37,904,100
Middle Atlantic states	83,202,200	+123.0	+ 30.3	328,480,400	− 15.3	12,689,400	40,373,500	18,447,400	.....	112,303,400
Pittsburgh territory	62,032,400	+ 8.8	+ 6.7	329,369,000	− 6.2	11,709,900	9,933,900	31,873,000	.....	62,229,000
Southern Michigan	19,479,500	− 12.1	− 33.0	94,495,300	− 6.1	4,813,500	4,009,500	5,590,100	.....	19,235,500
Chicago territory	83,759,600	+ 29.0	− 20.2	338,682,700	− 32.4	9,340,900	11,539,400	50,665,500	6,004,700	144,883,800
Central Northwest	15,557,400	+ 29.5	+ 40.0	53,623,300	− 1.8	1,548,200	8,672,300	3,948,400	.....	11,230,800
St. Louis territory	63,483,300	+100.9	+100.6	143,042,400	+ 7.0	5,237,300	31,918,600	23,647,500	1,314,900	48,310,400
Kansas City territory	65,233,500	+ 24.2	+ 96.0	187,267,600	+ 46.2	3,488,300	4,973,400	49,257,100	3,592,300	76,393,600
Texas	28,692,200	+100.0	+100.7	124,903,000	+ 9.7	2,462,400	4,950,200	17,800,000	1,328,800	36,761,700
New Orleans territory	9,195,600	− 35.0	−300.3	63,614,500	− 42.2	1,638,600	1,164,100	3,349,300	.....	4,421,900
Southeastern territory	30,066,500	− 41.2	− 15.8	176,703,600	+ 5.6	7,384,200	1,929,900	15,726,600	2,031,300	25,107,000

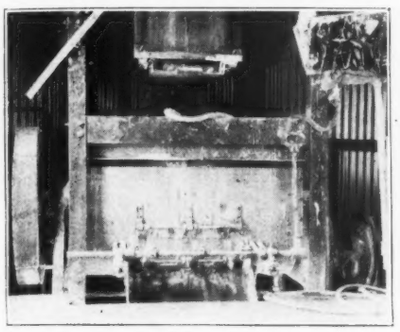
The Metropolitan New York territory includes northern New Jersey, Long Island, Westchester, Orange, Putnam and Rockland Counties. The upstate New York territory covers all counties north of Orange, Putnam and Rockland Counties. The Pittsburgh territory comprises western Pennsylvania, West Virginia, Ohio and Kentucky. By Southern Michigan is meant the so-called southern peninsula. Chicago territory embraces northern Illinois, Indiana, Iowa, eastern and southern Wisconsin. The Central Northwest territory covers Minnesota, North Dakota, South Dakota, northern peninsula of Michigan and northwestern Wisconsin. St. Louis territory comprises southern Illinois, eastern Missouri, northeastern Arkansas, western Tennessee and north western Mississippi. Kansas City territory includes western Missouri, Kansas, Oklahoma and Nebraska. New Orleans territory embraces Louisiana, western and southern Arkansas, eastern and southern Mississippi. The Southeastern territory includes North and South Carolina, Georgia, Florida, Alabama and eastern Tennessee.

Sand Producer Opens Mortar-Mixing Plant

ALABAMA OPERATION DESCRIBED

The Kirkpatrick Sand and Cement Co., operating a sand-and-gravel plant at Jackson's Lake, Ala., and a material yard in Birmingham, on June 1 put into operation a new ready-mixed mortar plant. This is located at the company's yard in the heart of the city's manufacturing district. The plant has a structural-steel framework with concrete footings and runways and has Tennessee corrugated-metal siding and roofing.

Sand is unloaded from cars by a Brownhoist steam locomotive crane handling a 1¼-cu. yd. clamshell bucket to a stockpile. Yellow sand



Mixer with batch box above.

from the company's plant and white sand from western Georgia are both stocked. The sand is then shoveled by hand into a wooden hopper from which a Link-Belt belt bucket elevator feeds to a 6-cu. yd. capacity steel bin at the top of the plant.

A ¼-cu. yd. batch box, with sliding gates at top and bottom, feeds to the Blystone ½-cu. yd. mixer. Lime and water are added in the customary manner and the mixer discharges directly into trucks below.

Square D safety switches, Crouse-Hinds conduit and General Electric motors are used.

The plant has a capacity of over 40 cu. yd. per day of either cement or lime-cement mortar. The product is delivered in dump trucks and is accepted for any kind of masonry construction.

Indiana Gravel-Washing Plant Installs Riffles

Following the finding of a 22-gram gold nugget in the gravel driveways of a cemetery at Gosport, Ind., riffles are being installed at the Gosport gravel-washing plant of the Cooley Gravel Co. of Bloomington, Ind., to catch any of the precious metal which may be present, according to press reports. The Cooley company supplied the gravel for the cemetery driveways where the nugget was found. Roy E. Long is manager of the plant and installation of the riffles in the sluiceways is being made by Edward Terry of Stinesville, Ind., who for many years had been engaged in gold mining in the West.

Michigan's State-Owned Cement Plant for Sale

Governor Fred Green of Michigan has announced that proposals for the purchase of the state cement plant at Chelsea, Mich., would be welcomed, as the state's administrative committee submitted a recommendation that the plant be sold owing to present business conditions.

The Chelsea plant cost the state of Michigan some $700,000 and has annually reported a deficit, the aggregate of which has now reached $742,295 after several years of operation.

General view of the new mortar plant of the Kirkpatrick Sand & Cement Co.

Cement Safety Heads Hear James J. Davis

EASTERN MEET AT WASHINGTON

Secretary of Labor James J. Davis was the principal speaker June 26, 1930, at the annual accident-prevention conference of the Portland-cement mills at Virginia, Maryland and southeastern Pennsylvania, in session at the Raleigh Hotel, Washington, D. C. The meeting which was attended by 80 operating executives, superintendents and safety directors, representing practically all the mills in the Chesapeake region, was held under the auspices of the Portland Cement Association and the National Safety Council.

Secretary Davis, who talked at the afternoon session, said in part: "Some of you may feel that you have come to Washington on a hot day, but whether it bothers you or not is largely a matter of viewpoint. I can remember some thirty years ago when I stood before a great steel furnace incomparably hotter than today's pleasant weather and was most thankful that I had a good job. The man who cultivates contentment of mind has found the real way to be happy.

"I am glad you men of the cement mills are keeping the human values foremost. Practice kindliness, watchfulness for those among whom you work and give your time to your work without reservation. By so doing you will be successful and some of the products will be worth much more to you than money."

Speaking of the relief which cement mills in the coast states will receive from the new tariff bill, Secretary Davis said, "The new tariff should help and put new life into the seaboard cement industry. It will go further than that. It will benefit the oil industry, the transportation industry and the coal industry, the latter of which is in great need. Our highways of cement in the future will be not 20 feet wide but 40 or 60 feet wide and a few years hence will solve the problem of congestion in our cities, for many of us will then find it practicable to live 40 miles or more away."

Other speakers during the session included Daniel Harrington, chief engineer, U. S. Bureau of Mines; Col. H. A. Reninger, vice-president, Lehigh Portland Cement Co., Allentown, Pa.; Dwight Morgan, vice-president, Lone Star Cement Co. of Virginia, Inc., Norfolk, Va.; and Wm. M. Powell, Medusa Portland Cement Co., Cleveland, Ohio.

A first-aid contest between a number of cement mill teams trained by the U. S. Bureau of Mines was a feature of the afternoon program in the ballroom at the Raleigh. John J. Porter, vice-president and general manager of the North American Cement Corp., Hagerstown, Md., acted as general chairman.

Business Conditions Good in Southwest

ONLY NORMAL UNEMPLOYMENT

Despite pessimistic reports to the contrary, business conditions in the Southwest appear to be holding their own.

Throughout the Southwest, agricultural conditions are satisfactory and water commerce showed a high total for the half year with ample provision for all requirements through to the harvest.

A reduction in wholesale commodity prices—taking an average of two hundred representative communities—is indicated. Wholesale commodity prices stood at 86.6 at the close of June against an average of 93.3 for the year 1929.

The employment situation does not appear to be as bad as it is painted. Los Angeles showed a population of 1,231,730 for the past census, and Federal statistics normally show an average of 4 per cent of the population normally unemployed. With Federal census figures showing unemployment for the city at about 44,000 or 3.9 per cent of the population, Los Angeles is shown to have a very commendable record.

Exports to foreign countries showed a remarkable increase in volume from Los Angeles, with 7,424,000 tons outbound, against 4,474,000 for June, 1929. The exports for the year ending June 30 showed a total commerce through the port of nearly $1,105,000,000, representing an increase of $160,000,000 over 1929.

All things considered, statistics and not rumor indicate good stable business throughout the Southwest.

Monterrey Cement Plant to Double Its Capacity

The Cementos Portland "Monterrey," S. A., has had such a material increase in the demand for its product that an extensive program is under way which will result in doubling the present capacity of the plant which will mean an eventual daily output of 2,000 bbl. per day. Construction is at present ahead of schedule and will undoubtedly be terminated in the early part of September. The expansion program will entail an expenditure of $750,000.

New York Crushed-Stone Men Gather at Buffalo

The New York State Crushed Stone Assn. held its annual meeting in Buffalo, N. Y., on June 27, at the Meadowbrook Country Club.

Arrangements for the meeting were made by James Savage and A. J. Hooker of the Buffalo Crushed Stone Co., and A. S. Owens, secretary of the association.

The question of the formation of a credit bureau was discussed, as well as the matter of proper selection of road aggregates. George E. Schaefer and F. C. Owens of the General Crushed Stone Co., Syracuse, N. Y., were appointed to examine the credit matter and report later. John H. Odenbach, president, called on E. N. Deitler of the National Credit Assn. to explain the credit service which the N. C. A. is prepared to offer the members. No definite action was taken, however.

Matters of general interest were discussed relative to the crushed-stone business and, upon termination of the discussion, President Odenbach asked for suggestions as to the next place of meeting. Various suggestions were offered and the decision was left to the discretion of the executive committee. Rochester, however, seemed to be favored.

Asbestos Corp. Delays Vote to Halt Payments

A meeting of holders of general mortgage bonds of Asbestos Corp. to act on the proposal of the directors for postponement of interest and sinking fund payments, due July 1 and January 1, 1931, was postponed June 30, due to the lack of a necessary quorum to pass on the resolution.

Action of 65 per cent of the $4,239,000 bonds outstanding is required for passing the resolution and only $1,303,000 bonds were reported in person, or by proxy. Nearly $1,000,000 was represented by the protective committee, formed recently.

The adjourned meeting will be held on August 4, in the Royal Bank Building, Montreal.

Old Quarry Reopened in Northeastern Wisconsin

Owing to the increasing demand for crushed stone by the northeastern Wisconsin market, R. S. Brunette has reopened the old M. Brunette quarry at Duck Creek, Wis. This plant was idle from 1920 to 1928, was then operated by the Wisconsin Stone & Duntile Co., and again vacated late in 1929. Several improvements have been made by Mr. Brunette, including the addition of a Williams No. 2 hammer mill. The plant's capacity is 100 tons per day.

Seek Limestone Deposits In Alpena, Mich., Region

The Hanna Furnace Corp., a subsidiary of the National Steel Corp., has employed the S. E. Atkins Co. of Duluth under contract to prospect a large tract of land near Alpena, Mich., for limestone deposits. Three diamond-drill outfits are now being set up preparatory to boring.

Soren Sorenson, geologist for the Hanna interests, has recently arrived in Alpena, where he will be in charge of the prospecting.

Florida Ready-Mixed Plant Highly Modern

CAPACITY 600 CU. YD. PER DAY

The Central Concrete Engineering Co. has been operating in Jacksonville, Fla., for the last four years. Numerous improvements have been made in the plant from time to time and at the present it is one of the most efficient in the south, fully capable of taking care of all of the concrete needs of the Jacksonville territory, according to The Explosives Engineer.

The plant is located on a spur track on which the material cars are spotted and unloaded. Gravel and sand are unloaded and deposited either in stock piles or directly into the overhead Johnson bins by an O. K. electric stiffleg derrick. The two bins each have a capacity of 90 tons. A housed Northwestern cement conveyor, electrically-operated, handles the cement bags from the cars to a storage platform in the rear of the bins.

Two 1-cu. yd. electrically operated Smith mixers mounted on concrete piers directly beneath the bins are so arranged as to discharge readily into a truck which drives beneath the mixer platform. The mixers discharge by tilting and when both are operating the capacity of the plant is 600 cu. yd. for a 10-hour day.

By having two mixers, it is possible to pour concrete of two different specifications at the same time and thus speed up delivery to separate jobs. The discharge hoppers under the bins are capable of being subdivided to cut the batch in the individual mixer to ¼ cu. yd. each.

The plant is so arranged that the trucks can turn around, back up or drive diagonally into the street in the quickest possible time. A well-built bungalow on the lot is used as the executive offices from which the trucks are handled on a time schedule. Next to this is the cement and tool storage shed, with a truck rack in front to speed up repairs to the fleet.

The haulage units used by the Central Concrete Engineering Co. include seven International 3½-ton trucks. They are capable of carrying 3 cu. yd. each, but usually carry only two. They are equipped with four forward speeds and are governed to run not more than 20 miles per hour. The concrete bodies are equipped with removable dividing sections for carrying one yard each of different specification mixes.

The plant manufactures concrete to specifications of 1,500, 2,000 and 3,000 lb. per sq. ft. and regularly has cylinders tested by the Southern Testing Laboratory to check up on plant operation. Each of the component parts of the mix is automatically measured and discharged into the mixers.

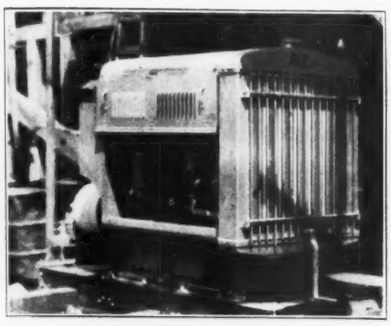
Produces Stone for New Oregon Highway

OPERATION IS DIESEL-POWERED

Knute Lien, La Grande, Ore., contractor, has taken the job of providing 45,000 cu. yd. of crushed rock for the Oregon state highway department. To provide the material as per contract, Mr. Lien will erect two crushing plants, one at Mile Post 39 on the Columbia River Highway, 39 miles from Portland; the other at Mile Post 52.

The plant at Mile Post 39 is already in operation. The first run of the plant produced 300 cu. yd. of material on one shift and Mr. Lien expects to raise this to 400 cu. yd. later on. Total output per shift of the two plants will be approximately 800 cu. yd. The plants will operate day and night.

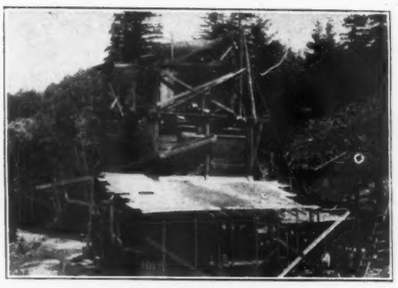
The rock is brought to the plant by a dragline equipped with a 1½-cu. yd. bucket. The material is dumped into chutes which carry it to the 12-in. by 24-in. primary jaw crusher. A 3-ft. Symons cone crusher does the secondary crushing. Washing and sizing are done in a 30-in. by 12-ft. revolving scrubber screen, the material being elevated from the secondary crusher by a Howard-Cooper chain elevator on 50-ft. centers. After being washed and sized, the finished material is diverted to storage bins or in piles according to the term of the contract with the state highway department. A Buda M. A. N. 120-hp. Diesel engine supplies the power for the entire plant. Biflex belting is used throughout to transmit the power. This belting, as well as the pulleys and a double-drum hoist, were furnished by the Howard-Cooper Corp. of Portland, Ore.



Diesel engine which furnishes power for entire plant.

An outstanding feature of the plant has been the remarkable performance of the Diesel engine. Fuel cost has averaged only $2.80 per shift —40 gallons at 7 cents per gallon. The oil is received in drums, requiring no expensive handling, and is quickly and easily converted into economical power.

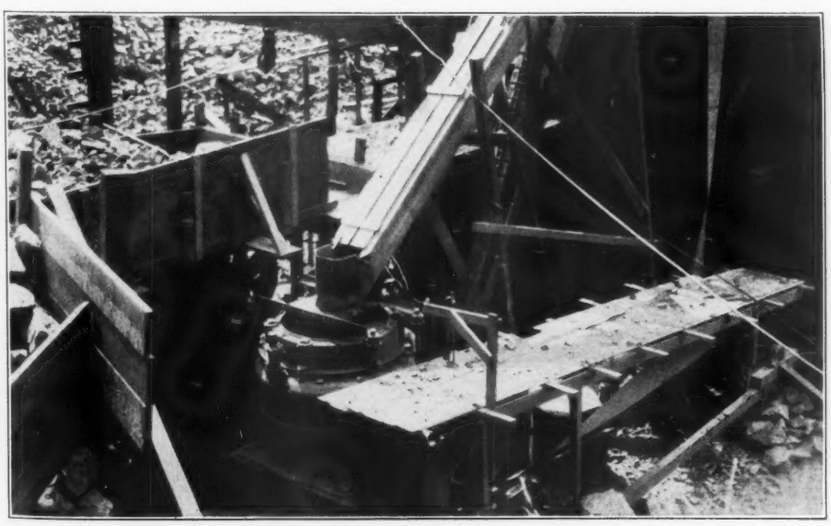
The present plant at Mile Post 39 will deliver about 15,000 cu. yd. of rock to be distributed in stockpiles along the work at 3 or 4-mile intervals. It will then be moved to a point near La Tourelle, Ore., to complete the job.



Plant at Mile Post 39.

Bluffton Stone Co. Has New Quarry in Operation

The Bluffton Stone Co., Bluffton, O., has just started operations in a new quarry. Crushing is proceeding smoothly with new electrically-driven machinery and a total of 180 hp. is employed.



View of the crushers and chain-bucket elevator.

Merge Blue Diamond Firms in California

MAKERS OF GYPSUM PRODUCTS

The entire assets of the W. C. Hay Corp., the Blue Diamond Co., the Blue Diamond Cement Co. and the Blue Diamond Co. of Nevada have been sold to the Pacific Group Co., Los Angeles, which has transferred them to a newly-formed corporation known as the Blue Diamond Corp., Ltd.

Announcement of the transaction, one of the largest in the building-materials field to be effected in recent years, was made officially on July 8. The properties of the four companies whose assets are now merged in the Blue Diamond Corp., Ltd., include approximately 25 acres at Sixteenth and Alameda streets, Los Angeles, on which are located a plaster mill for the manufacture of hard-wall plaster and other plaster products; plants for the manufacture of gypsum block, mixed mortar and Portland cement; a reinforcing-steel fabricating plant, a warehouse and other necessary facilities for carrying on a general building material distribution business, all in Los Angeles.

In Nevada is located a large deposit of high-grade gypsum, connected with the main line of the Union Pacific by a corporation-owned 25-mile railroad. Other assets comprise a lime property and gypsum deposit in the Imperial Valley, and sand, rock and gravel deposits in both the San Gabriel and San Fernando Valleys, both immediately adjacent to metropolitan Los Angeles. Included with the above deposits are the necessary manufacturing plants, bunkers and equipment to prepare and distribute the wide variety of material handled.

Permanent officers of the new corporation have not as yet been selected, it was announced. W. C. Hay, who has heretofore been general manager of the various properties, is retiring from active management, but otherwise the personnel of the company will remain the same, it is understood. Mr. Hay retains his membership on the board of directors.

Lee Phillips, head of the Pacific Group Co. which brought about the reorganization, will be remembered as the moving spirit back of the several recent consolidations in Southern California, among them being the Consolidated Rock Co., large producers and marketers of rock, sand and gravel; and the Consolidated Steel Co., the largest fabricators of structural steel on the Pacific Coast.

It is believed generally among the producers of building materials in Southern California that the reorganization will tend to stabilize the entire industry in this section, especially from a market standpoint.

Salt Yielded by Sea-Water Evaporation Harvested by Huge Tractor

California Company Uses Unusual Method Of Handling and Refining Large Tonnage

By H. W. BARTLETT
Superintendent, Alviso Salt Co., San Francisco, Cal.

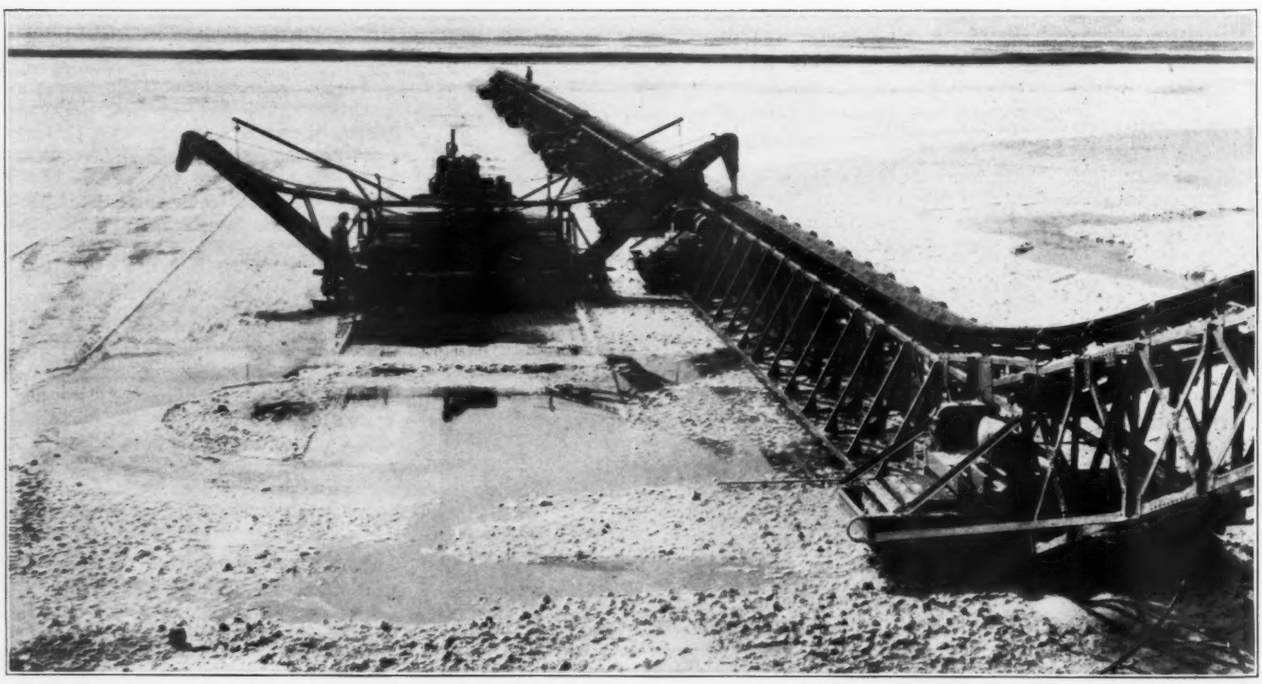
ABOUT 95 PER CENT of the salt produced along the western coast of the United States is obtained from the solar evaporation of sea water, and by far the largest portion of this is produced along the level marsh lands of the southern end of San Francisco Bay. It is here, between the towns of Mayfield and Alviso, that the Alviso Salt Co. has completed a modern series of ponds with washing and shipping facilities. The plant layout and equipment were designed by the writer.

Two sets of ponds are used in the process. The first or concentrating ponds are used to bring the weak 3 per cent solution of sea water up to saturation with respect to salt, or to about 26 per cent. The crystallizing ponds, where the salt is formed and whence it is gathered or harvested, form the second set.

As the marsh lands are just above a normal high tide, it is necessary to pump the water into the first or receiving pond. In order to decrease the pumping head and to give a 24-hr. pumping rate, a large section of one of the marsh sloughs has been dammed off and connected to the bay by large swing or check gates, which allow the water to flood in during high tide and hold it there. Two pumps, one of 10,000 gal. per min. and the second of 20,000 gal. per min., allow a very flexible pumping rate which, of course, varies with the rate of evaporation.

The water circulates about 15 miles to the last concentrating or pickle pond. This pond is separated from the other concentrating ponds, as it is here that the water is brought to saturation. On account of the great distance the water has traveled, the saturated condition of the brine, and the large range of pumping rates necessary, an old-style paddle wheel is used to lift the brine into the pond. It is used also for handling the brines in and about the crystallizing ponds. It is about 16 ft. in diameter, and 12 ft. across, and is capable of handling about 10,000 gal. per min. with about a maximum lift of 5 ft. During the summer months, when the evaporation is highest, it requires about two months for the water to travel from the intake to the pickle pump.

The brine in the pickle pond, known as "pickle," is added to the various crystallizers as required, the practice being to hold a fairly uniform depth on these ponds in order to control the size and hardness of the salt formed. Deep water tends to



View of the huge harvesting tractor depositing the salt on belt conveyor which carries it to the barge.

View from top of salt bunker showing barge rounding bend in canal. Salt ponds at right.

produce large, hard crystals. Due to impurities in the brine it is necessary to remove the brine from time to time, as the density increases, in order to hold a high purity in the salt. This strong brine, known as mother liquor, is removed two to three times per year and replaced with fresh pickle.

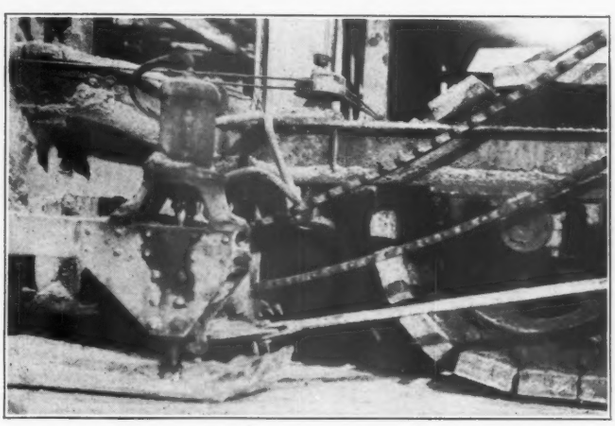
Nature is a great aid in the production of solar salt in this locality. First, the level marshes permit the easy construction of the ponds on cheap land. The rainfall is light, varying from 9 in. per year at Alviso to 18 in. further north. The yearly evaporation is 48 in. or more, with about 9 in. during each of the best months—July and August.

Transformer station for bringing power from high-tension lines to field conveyors.

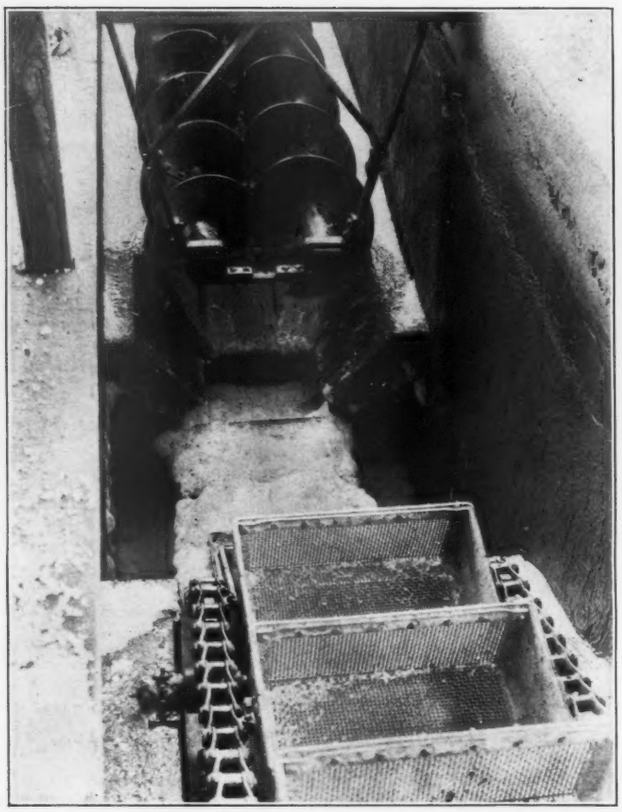
The order of separation of the various compounds from their complicated solution in the seawater is a very important item in the production of salt. Thus the iron and most of the calcium salts are crystallized out before the brine reaches saturation, while all of the more soluble magnesium and potassium salts are held in solution until about 80 per cent of the salt has crystallized. Thus it is possible, by washing the freshly-harvested salt sufficiently to free the adhering mother liquor, to produce salt of 99.7 per cent purity. The *artemia salina*, or brine-bug, which lives in the stronger brines in countless numbers, devours all organic matter and thus is a great aid in the production of a pure salt.

After the ponds are flooded with seawater and no concentration begins, it takes several years to get them in shape. This is due to the quantity of fresh water in the soil below the surface which must be brought up to the density of the brine in the ponds. This long process is known as "salting the ground." Its length depends upon the nature of the soil.

When once in shape the rainfall does not greatly affect the density of the concentrators and it is possible by April, usually, to concentrate enough to



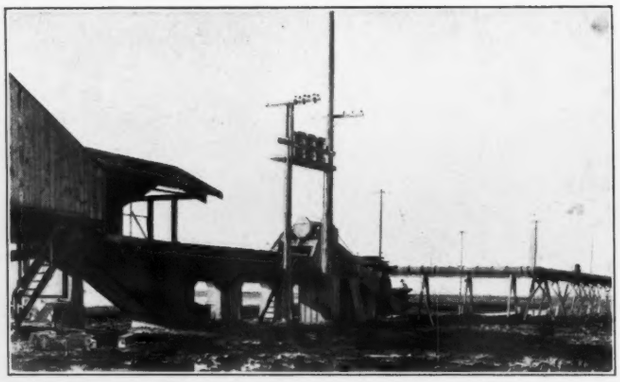
Close-up of harvester showing salt cutters with chain drive.



Discharge of salt from washing screws to basket elevator.

start crystallizing. By July 15 to the first of August, 3 to 4 in. is usually formed and the harvest begins. Ponds that are harvested in the late fall may have 7 to 8 in. Harvest is completed usually by the first of the year when the heavy rains set in and hence it is a seasonal enterprise. It is necessary that all equipment function well during the harvest period.

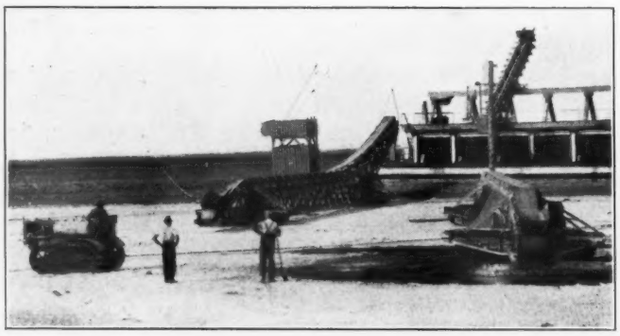
Interesting and efficient schemes and machines have been developed by this company to facilitate harvesting and handling salt in the field. A series of canals large enough to handle a 650-ton barge have been constructed between crystallizers. The barge is built so that it can be connected at one



View of washing plant showing pipe line for running washing water to sump.

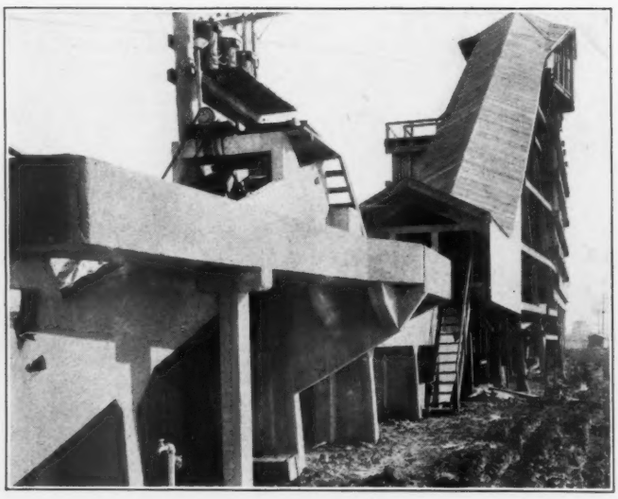
end to the first washing unit at the plant. A harvesting machine and a system of long, portable belt conveyors gather the salt from the ponds and load it into the barge. Two men handling this equipment can harvest at a rate of 175 tons per hour.

The harvesting machine consists of a Caterpillar

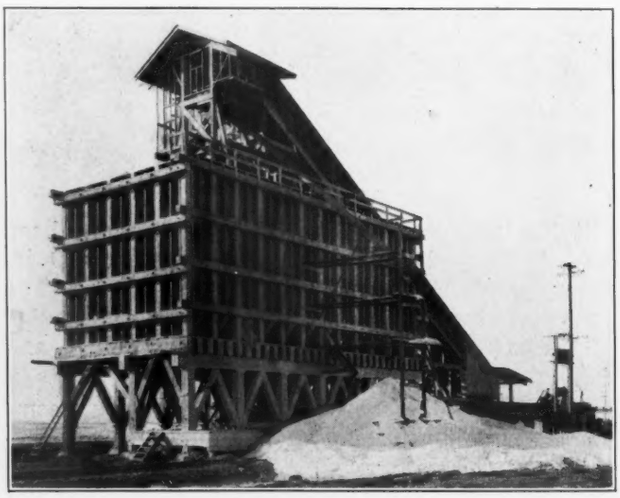


Tractor pulling field conveyor into place. Barge and flight conveyor in background.

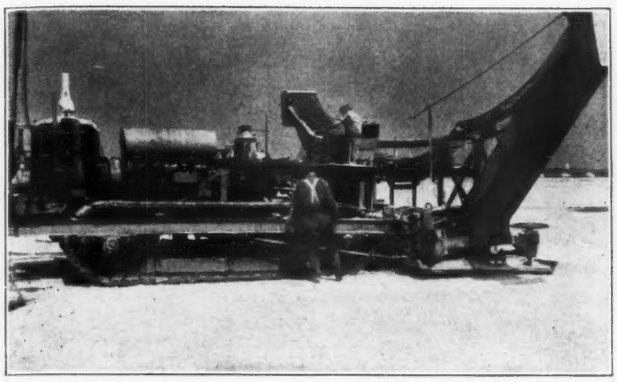
60 power-plant and transmission mounted on a special frame and on large wooden tracks to avoid cutting the ponds. A revolving pick, roll, and pick-up conveyor are mounted on a separate frame and drag along behind the tractor on two large shoes. Hydraulic cylinders handled by the operator on



Close-up of washers showing concrete flumes.



Bunkers for storing the crude, washed salt.

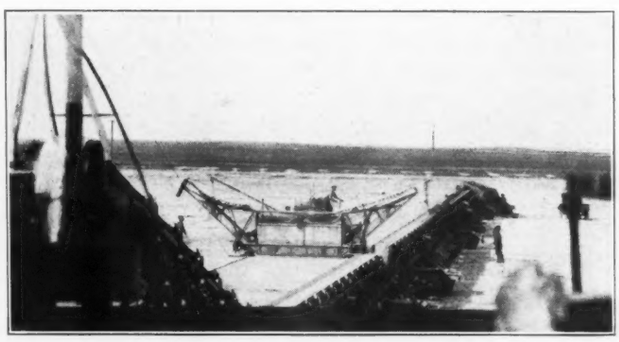


Close-up of tractor showing special crawlers and loaders.

Crane handling salt from storage pile to car.

the tractor raise or lower the frame and hence vary the depth of cut. The conveyor is inclined and loads the salt onto the portable belts. Power to drive the roll and conveyor is taken from the tractor motor. The machine cuts a swath 15 ft. wide at a rate of 10 to 18 ft. per min., depending on the thickness of salt.

The conveyor belts are carried on wooden tracks similar to those on the large tractor and are placed

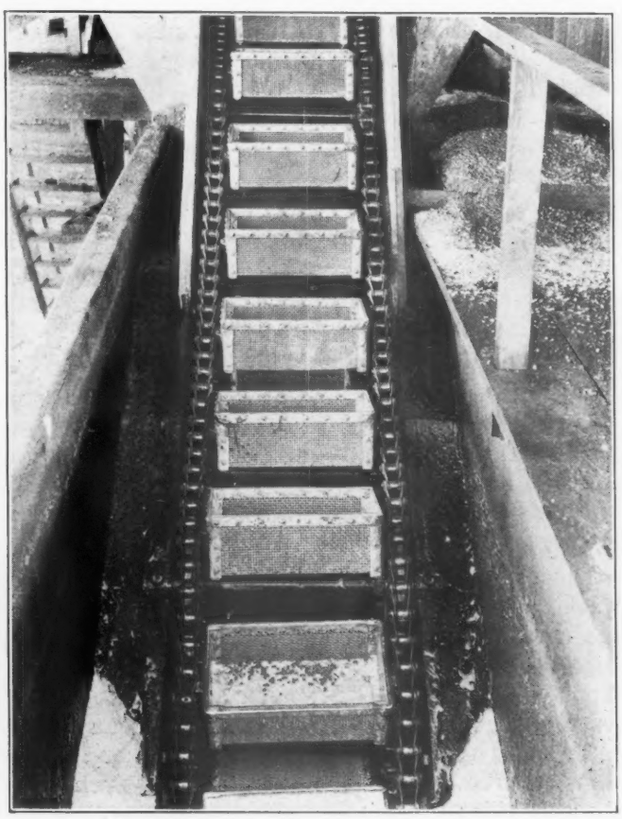


View from barge showing field conveyor discharging to flight conveyor.

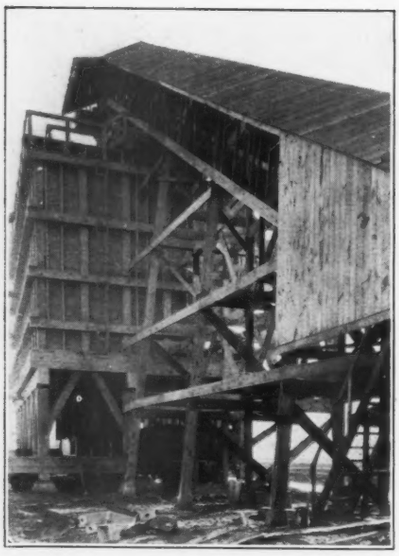
end to end in series. Four lengths, in use at present, reach halfway across one pond, two 100 ft. and two 125 ft. long. Three of these field conveyors were furnished complete by Stephens-Adamson Manufacturing Co. Four more are to be added to reach all the way across the pond. The conveyor tractors are mounted transversely to the belt about 18 ft. from each end. Three electric motors are mounted on each unit—one on each tractor and one to drive the belt. There is a switching station on each unit with switches to operate (1) all tractors, ahead or reverse; (2) all belts, start or stop; (3) head tractor motor on that unit, ahead or reverse; (4) rear tractor motor, ahead or reverse; (5) stop button for belt motor on that unit. Thus, the entire line of conveyors can be driven down the field from any station, but should it be necessary to align a small unit, it is necessary to go to that station.

During harvest operations the belts extend across the pond and over the levee to the barge conveyor. The harvester operates alongside the string of belts. When a belt is not in use it is cut out by stop button No. 5. As the harvester reaches either end of its travel it is necessary to move the belts over 15 ft. and to turn the harvester and

Drag-chain conveyor on head end of the barge.



Basket elevator which raises salt from washers to bunker.



Storage bunker and inclined run of basket elevator.

bring the barge conveyor into line, all of which takes two men about two minutes.

The conveyor units are moved from pond to pond on a special work barge. Direct drives are used almost entirely throughout the several operations, speed reducers made by the Pacific Gear & Tool Co. being mounted with General Electric motors. Special cast-steel drive heads were deemed necessary for several massive and heavy-duty units and these were furnished by the Joshua Hendy Iron Works.

The barge has a large hopper with loading and unloading conveyors mounted. The loading conveyor is inclined in order to raise the salt up to the center, it can be raised or lowered as the conditions of the levees or ponds demand and can be racked back and forth on the barge to facilitate loading. The conveyor chains weigh about 13 tons and were made by the Joshua Hendy Iron Works. At present the barge is towed to the washing plant by a tractor. It is planned, however, to build or purchase a suitable towboat for this purpose.

Power for the conveyor belts and barge loading conveyor is obtained from a portable substation which is moved along the levee with the harvest operations. It transforms the voltage from 4,000 to 220. Due to the very severe conditions imposed by the salt, special wiring was used throughout, and many precautions were taken in making the connection to the 4,000 volts. During several months' operation there has been little trouble with the equipment.

We find, also, that the belts track nicely through the field and hold their alignment very closely. If one unit should run out, it is brought back in a moment without disturbing the rest.

During the unloading operations at the first washer, brine is added to the barge hopper in which the unloading chain operates, and thus the barge becomes a part of the first washer. The discharge from the barge at the washer drops into a log washer, made up of two Stephens-Adamson 18-in. screws, a right and left, running together in the same concrete trough, the rotation being such that the salt rides up between the two screws. With the slipping, rolling action that takes place on the incline, and the brine present as the salt enters the log washer, all mud or other impurities are loosened up so that they are removed as soon as the salt drops into the succeeding horizontal washer.

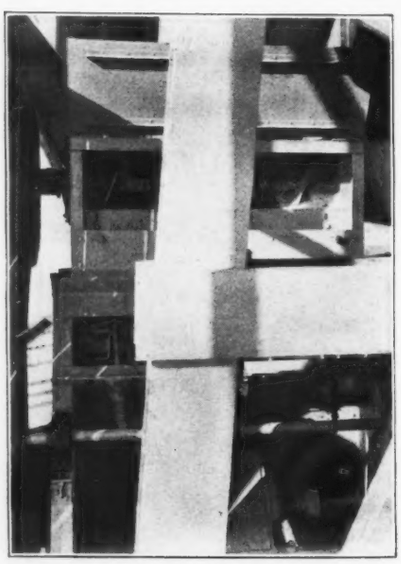
The horizontal washer also contains two large Stephens-Adamson screws which rotate in reverse directions beneath a saturated brine and create two streams along the walls of the concrete trough. In this manner the fresh material is exposed to a large surface of brine into which the salt is mixed while mud or other solids are conveyed to waste. This is the salt's best and final washing.

A Stephens-Adamson inclined-screen basket elevator next raises the salt to the top of the first bunkers. From these bunkers the salt may be screened for some of the coarser hide-salt grades and the balance dropped into one bunker, or it may drop unscreened into another bunker to be dropped into large gondola cars and taken to the plant storage. During harvest operations all bulk shipments are made from this bunker; otherwise bulk cars are loaded at the storage pile by the plant crane.

A K-55 Link-Belt crane with 2½-cu. yd. bucket is used for handling the salt to and from the storage pile. A track extends on each side. Later, as capacity demands, a third track will be extended through the center of the piling place. The cars from the first-washer bins are unloaded alongside the tracks in piles about 30 ft. high. Due to the adhering mother liquor, it is preferable, with the operations in the rewashing plant, to stack the salt for a time to allow it to drain before rewashing to the better grades as used in packing.

The rewashing plant has been constructed alongside the Alviso slough which, with a spur track on the opposite side of the washer, gives either water or rail shipping facilities. The rewasher consists of a large concrete track hopper with feed roll, grinder and a washing unit similar to the first washer horizontal screws. The feed roll, manufactured by the Mutual Iron Works, is a 24-in. drum mounted on trunnions and operated just under the opening of the track hopper for its full length, 50 ft. The opening on top of the roll is such that the angle is too flat for the salt to flow unless the drum is ro-

(Continued on Page 62)



Vibrating screen for sizing the crude salts.

Non-Metallic Minerals Play An Important Part in Illinois Industry

Portland Cement, Sand and Gravel Lead in Importance; Lime and Fluorspar Next

THE mineral resources of Illinois consist of coal, clay, oil and gas, limestone, cement-making materials, silica sand, sand and gravel, molding sand, fluorspar, tripoli, fuller's earth, peat, and very minor amounts of lead and zinc. During the five-year period, 1922-1927, the value of the total production averaged $239,094,642 per year, giving Illinois a rank ahead of 41 other states in the Union. (See Table I.) Of this amount approximately 63 per cent was from coal, 11 per cent from clay and clay products, 5 per cent from oil and gas, 5 per cent from sand and gravel, 3½ per cent from limestone, and 12½ per cent from other products.

Limestone

A variety of limestones, widely distributed, exist in Illinois and supply aggregate for road material and concrete, railroad ballast, flux, agricultural limestone, lime, cement, whiting, building stone, and for other uses. Dolomitic limestones underlie the northeastern and northwestern parts of the state and calcite limestones underlie the area from Rock Island south to Cairo. The "coal measures" area, which comprises most of the rest of the state, is in the main without limestone, but locally, as at La Salle and Oglesby, there are important deposits.

Dolomite limestone of the Niagaran age is extensively quarried in the Chicago region and near Port Byron, and Galena dolomite is quarried at Rockford and Belvidere. Quarries of high-calcite limestone occur at Rock Island, Quincy, Alton, and Columbia. The crushed-limestone industry is Illinois' most important non-metallic mineral industry, from the standpoint of quantity of material produced.

TABLE II—PRODUCTION OF CRUSHED LIMESTONE IN ILLINOIS IN 1927

Kind	Tons	Value
Rubble	14,270	$ 24,309
Rip-rap	620,184	639,534
Road material and concrete	6,436,870	5,231,749
Railroad ballast	1,159,160	746,757
Flux	683,840	706,675
Agriculture	647,155	579,639
Miscellaneous	88,790	166,423
Total	9,650,265	$8,095,086

The amount of agricultural limestone produced is twice that produced by any other state. Illinois also ranked first in the quantity of rip-rap sold, and fourth for the total amount of crushed limestone produced.

Geographically, the crushed-stone industry is fairly well distributed over the state. In the Chicago district there are approximately 20 shipping quarries; in the East St. Louis district, 7; in the Quincy region, 4; and in addition, there are outlying plants at many other points throughout the state. The largest production, however, comes from the Chicago district. Of the state output, Cook, Du Page, Kankakee, and Will counties furnish 78 per cent by value and 83 per cent by quantity.

The crushed-stone resources of Illinois are tremendous. In the Chicago district most of the existing plants have large reserves of unquarried

*Abstracted from *Illinois—Resources, Development, Possibilities.* Published 1930 by Illinois Chamber of Commerce.

TABLE I—VALUE OF NON-METALLIC MINERALS PRODUCED IN ILLINOIS, 1923-1928

	1923	1924	1925	1926	1927	1928
Sand						
Glass	$ 754,190	$ 656,655	$ 636,355	$ 465,458	$ 356,333	$ 422,923
Molding	720,178	637,961	601,852	596,295	455,913	531,468
Structural	1,933,060	1,595,084	1,539,182	1,902,800	1,954,694	2,110,951
Paving and road-making	704,883	976,838	1,277,456	1,068,209	1,124,956	1,163,281
Cutting, grinding and blast	451,828	480,184	677,164	727,774	692,984	705,895
Miscellaneous	260,555	157,353	538,087	920,086	1,156,223	2,168,751
Ground silica sand (quartz)	480,302	578,043	529,934	529,350	462,084	.....
Total	$5,304,996	$5,082,118	$5,801,030	$6,209,972	$6,203,907	$7,123,269[1]
Gravel						
Structural	$1,241,865	$1,324,295	$1,152,803	$1,213,051	$1,237,709	$1,573,130
Railroad ballast	334,867	367,292	470,089	[2]	648,985	477,183
Paving and road-making	1,059,312	1,086,104	1,246,102	1,370,726	1,535,623	2,069,973
Miscellaneous	[2]	[2]	[2]	457,812	3,514	.....
Total	$7,460,738	$7,281,766	$8,140,090	$8,714,350	$3,425,831	$4,120,286
Miscellaneous						
Fluorspar	$1,443,490	$1,288,310	$1,024,516	$1,012,879	$ 863,909	$1,154,983
Sandstone	49,173	43,051	36,678	39,073	32,420	49,173
Barytes, feldspar, marl, tripoli, and fuller's earth	3,255,836	2,408,588	537,823	788,071	590,632	.....
Total	$4,748,499	$3,739,949	$1,599,017	$1,840,023	$1,486,961	$1,204,156

[1]Except silica.
[2]Figures are not available.

stone obtainable either by extending or deepening their present quarries. Additional good quarry sites exist which can readily be developed when economic conditions warrant.

In the bluffs of the Illinois, Mississippi, and Ohio rivers and in northwestern Illinois are many splendid sites for the production of high-quality crushed stone. Some of these sites are adjacent to both rail and water transportation.

Lime

High-calcium lime is produced from native stone at Quincy and dolomitic lime at Chicago and Port Byron. Each of these limes has its own special uses, but many uses are common to both.

A large part of the lime produced in Illinois is sold as quick lime. Some is produced and marketed as hydrated lime.

Table III reveals that Illinois' production of lime in 1927 was 115,803 tons valued at $1,084,093 and gave the state eleventh place in the nation.

TABLE III—PRODUCTION OF LIME IN ILLINOIS IN 1927

Kind	Tons	Value
Building—hydrated	11,499	$ 103,406
Building—quick	52,051	588,119
Paper mills—hydrated	393	3,376
Paper mills—quick	11,603	93,446
Other chemical and metallurgical lime—hydrated	18,017	162,459
Other chemical and metallurgical lime—quick	22,240	163,293
Total	115,803	$1,084,093

A large part of the production shown in Table III is high-calcium lime burned in the Chicago district from limestone imported by barge from Michigan. However, considerable quantities of lime are burned from native stone in the Chicago, Port Byron, and Quincy districts, as well as small amounts at scattered points through the state.

Northern Illinois has an abundant supply of dolomite favorably located for the manufacture of dolomitic lime, but no very thick or persistent high-calcium limestone formations. In the west-central and southern parts of the state there are many points close to railroad or water transportation where high-calcium lime can be produced.

Cement

The cement manufactured in Illinois includes Portland cement and hydraulic cement.

Illinois was the seventh most important cement manufacturing state in 1928, having an output of 7,334,833 barrels, valued at $11,486,348. Of this production a large part came from the La Salle area where a "coal measures" limestone and shale are used as raw materials. The balance came from Dixon where a part of the Platteville limestone and a surficial clay are used as raw material. There are other places within 150 miles of Chicago where suitable raw materials are probably available, and still more places occur in the western and southern parts of the state.

The hydraulic cement industry of Illinois is located at Utica. The Shakopee dolomite bluffs of Illinois River west of Utica were the site of many

Fig. 1. Location of sand and gravel pits in Illinois.

mines and a flourishing industry in the pre-portland cement days. At present only one company is operating and the limestone is quarried and treated by modern equipment and methods.

Silica Sand

The state's entire production of silica sand comes from the St. Peter formation, which outcrops along the Illinois Valley between Ottawa and Utica, along Fox River between Ottawa and Millington, in northern Illinois in the vicinity of Oregon and Haldane, and in western Illinois in Calhoun County. The Ottawa-Utica region is the most important from the standpoint of production. The industry has found favorable conditions for development in this area because the bluffs and rock terraces along Illinois River offer good quarry sites and nearby railroad transportation.

Two classes of silica sand are produced, washed and crude. Washed sand is sold for many purposes, among the most important of which are the manufacture of plate glass, plastering and sand-finishing walls, stone cutting, grinding purposes, sand blasting, engine sand, and filter sand, and

Fig. 2. Limestone, lime, cement and fluorspar plants in the state of Illinois.

manufacture of sodium silicate. The Standard Ottawa sand is a carefully-screened coarse sand which is used throughout the United States for cement-testing and for other purposes requiring a standard, uniform sand.

One other special product is ground quartz, also known as silica, which is made by grinding the washed sand to a very fine powder. It is sold for use in making scouring soaps, as a paint filler, and as an inert mineral filler for other purposes. The crude sand is sold principally as steel molding sand and as fire and furnace sand. In 1927 Illinois was the nation's largest producer of silica sand. The production and its distribution as to products is shown in Table IV.

One of the outstanding features of the St. Peter sandstone is that it is composed of hard, solid grains of pure quartz or silica, which property adapts it to many uses. But the sand has other interesting characteristics. The grains are for the most part rounded, the surfaces frosted, and the formation is loosely cemented so that it is readily and cheaply disintegrated from solid rock into sand. The crude sand is usually somewhat yellow in contrast with the washed sand which is white. The color is due to a small amount of iron oxide.

The future of the silica-sand industry in Illinois seems to be excellent. Within the last two years mergers have been effected to eliminate wasteful competition between producers and to put the industry on a sound financial basis. Though many companies have exhausted their supply of most easily obtainable sand, enormous quantities of sand are still available at the present quarries. New possible quarry sites are for the most part handicapped by lack of transportation, or by a heavy overburden, but exploratory testing will probably reveal additional good sites.

TABLE IV—PRODUCTION OF SILICA SAND FROM THE ST. PETER FORMATION IN ILLINOIS IN 1927

Kind	Value	Tons
Glass	$ 356,333	629,268
Structural	62,816	59,260
Steel Molding	232,436	525,874
Cutting, grinding and blast	692,858	362,559
Engine	10,947	8,838
Ground quartz	462,804	83,028
Fire and furnace	19,871	24,521
Miscellaneous	178,465	205,131
Total	$2,121,508	2,407,753

Sand and Gravel

Most of the sand and gravel in Illinois is primarily of glacial origin and occurs principally as outwash plains, as terrace remnants or valley fillings, and ridges and hills of gravel. The most important deposits occur along the Rock, Fox, Du Page, Des Plaines, Illinois, Sangamon, Wabash, Kaskaskia and Embarrass rivers and their tributaries. The deposits are also most abundant in the northeast part of the state. Some sand and gravel is dredged from the Ohio and Mississippi rivers. Minor deposits of other character are scattered over the state.

In southern Illinois there is no glacial gravel, but there the novaculite or shattered chert, the "Lafayette" or brown-chert gravel, and the "Elco" or white-chert gravel provide abundant resources. Stream gravel is more or less abundant over the entire state. Fig. 1 shows the locations of sand and gravel pits in Illinois in 1927.

Molding Sand

Ideal molding sand consists of lime-free, siliceous sand in which there is sufficient clay to serve as bond. Much of the molding sand produced in the state consists of weathered sand which was originally deposited by glacial waters. The principal areas from which any considerable amount of molding sand is produced occur in the vicinities of Greenville, Ritchie, and Rockton, and along the Mississippi River. (See Fig. 1.)

Fluorspar

The fluorspar industry of Illinois is centered in Hardin County in Southern Illinois. (See Fig. 2.) The fluorspar occurs in veins and sheets in limestone. The veins vary from a few inches to sev-

eral feet in width, and have been worked to a depth of about 600 ft. or more.

In 1928 Illinois occupied second place among the producers of fluorspar with an output of 65,884 tons valued at $1,154,983.

At some places near the surface fluorspar is also found as a gravel in a clay matrix, formed by the surface weathering of fluorspar veins. Only a relatively small amount of spar is obtained from this type of deposit.

In 1927 Illinois occupied second place among the producers of fluorspar with an output of 46,000 tons valued at $863,909.

Tripoli

The tripoli of Illinois is produced from one of the older rock formations of Alexander and Union counties. It is essentially pure silica and has been formed by the weathering of a chert formation. The tripoli is mined by room-and-pillar methods, subsequently wet-ground to extreme fineness, then dried and sacked for shipment.

Illinois tripoli is used in the manufacture of buffing compounds, as an extender or filler in paint manufacture, for the manufacture of scouring soaps and powders, as a ceramic material and as an inert mineral filler.

In 1926 Illinois ranked among the foremost producers of tripoli.

The resources of the state as regards this product are very large. The deposits of the southern part of the state have for the most part been only touched. A larger market for the product, and good transportation facilities will aid the development of this industry on a much wider scale.

Fuller's Earth

As the result of the production from two plants near Olmstead in Pulaski County, Illinois ranked fifth in 1928 in the production of fuller's earth. The fuller's earth, which comes from the Porters Creek formation, is a gray clay of light weight and has the property of absorbing basic colors from oils. Some fuller's earths are capable of clarifying only one type of oil, that is, either animal, vegetable, or mineral oil, but the Illinois earth is said to be suited for clarifying any kind of oil.

A large percentage of the fuller's earth produced in Illinois is used for clarifying mineral oils, but some of it is also sold for use as an inert mineral filler, and for other purposes.

The raw earth is obtained from quarries in the bluffs of Ohio River, is loaded by steam shovels into cars and conveyed to the plant where it is crushed, dried, recrushed, pulverized and finally sieved. Four grades are manufactured.

It is probable that the Porter's Creek formation underlies a considerable area in southern Illinois, but only certain parts of the formations have value as fuller's earth. However, exploration of some of the known outcrops will probably reveal additional bodies of fuller's earth both in the Olmstead and outlying districts.

Production of Gypsum Decreased Two Per Cent in 1929

The gypsum industry in 1929 continued active but was not so productive as in 1928, according to a statement made public by the United States Bureau of Mines, Department of Commerce, based on reports received from 59 operators in 17 states and collected in cooperation with the Geological Surveys of Iowa, Kansas, Michigan, New York, Oklahoma, South Dakota, Texas, and Virginia.

The quantity of gypsum mined in the United States in 1929 was 5,016,132 short tons, a decrease of 86,118 tons, or 2 per cent, compared with 1928. This production, however, was greater than that of any year prior to 1924 and was more than twice as large as that of 1919.

The total value of the calcined and uncalcined gypsum sold by producers was $31,292,969, a decrease of $743,194, or 2 per cent, compared with 1928. The quantity of gypsum sold by producers without calcining in 1929 was 1,065,697 short tons, an increase of 66,285 tons, or 7 per cent, over 1928, and was valued at $2,096,779, or $1.97 per ton, an increase of $194,745, or 10 per cent, in value and of 7 cents per ton; the quantity of calcined gypsum sold by producers was 3,361,580 tons, a decrease of 279,805 tons, or 8 per cent, and was valued at $29,196,190. This was a decrease of 3 per cent in total value compared with 1928.

New York continues to be the largest producer of gypsum. The production of crude gypsum in that state in 1929 was 1,284,338 tons, a decrease of 15 per cent from that of 1928. This was 26 per cent of the entire quantity mined in the United States. New York is also the largest seller of gypsum, marketing 298,793 tons without calcining, or 28 per cent of the United States total, and 859,147 tons calcined, or 26 per cent of the total. These figures represent an increase of 11 per cent in the uncalcined and a decrease of 20 per cent in the calcined gypsum compared with 1928. Other important States in the production of crude gypsum in 1929 were Michigan, 898,547 tons; Iowa, 718,503 tons; Texas, 520,519 tons; Ohio, 374,008 tons; Oklahoma, 369,433 tons; and Nevada, 225,514 tons. The first five states reported 76 per cent of the total production.

The importation of gypsum constitutes quite an important factor in the industry. In 1929 eight importers with 13 plants in 10 states, namely, California, Connecticut, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Vermont, Virginia, and Washington, reported to the Bureau of Mines that they imported 1,017,791 short tons of crude gypsum, an increase of 7 per cent compared with 1928. These importers reported 83,681 tons of gypsum sold uncalcined, valued at $331,979, a decrease of 31 per cent in quantity and 26 per cent in value compared with 1928. The imported gypsum sold calcined in 1929 amounted to 820,737 tons, valued at $7,842,523, an increase of 2 per cent in quantity and value, compared with 1928.

Future Possibilities of the Simplified Invoice in Plant Accounting

By GEORGE A. COOPER
Division of Simplified Practice, Bureau of Standards, Department of Commerce

THE National Association of Purchasing Agents is largely responsible for the development of a single standard form of invoice, which has been termed the simplified invoice and which has been so widely adopted. There are certain facts which will enlighten many as to the present situation. The future possibilities of this form are largely dependent upon the course of action taken by buyers of commodities.

Commercial forms, including invoices, have a background of history. The keeping of records is as old as civilization itself. Little record has been left by ancient peoples whereby a very definite idea can be formed as to their methods, but sufficient data have been discovered to prove the existence of a highly-organized trade, and to point out some of the tools and means by which that trade was conducted.

Three or four thousand years ago, Babylonia was a flourishing state. The code of Hammurabi, a ruler of Babylonia, 2285 B. C. to 2242 B. C., shows that drafts and checks were common, sales were made and inventories recorded. Such records were kept on the front, back and sometimes the edges of sun-baked tablets or slabs, which varied in size from one-half by three-quarters inches to as large as 9 by 12 inches. This writing on the front and back of an invoice really has a precedent. Although writing on the edge has been abandoned, it may still be necessary to find a way to revert to this ancient custom if many companies still continue to fill both the front and back of invoices with miscellaneous notations.

In Egypt, accounts were kept on papyrus. Taxes were usually payable in kind. This necessitated the building of granaries and depositaries of various kinds for the storing of receipts—government warehouses, as it were. The taxpayer bringing his grain was stopped at the first entrance to give a record of his payment, and again at the point where formal delivery was made. Here a second record of the amount was written down. This method of auditing by means of duplicate, but distinct, records contains the germ of many modern methods.

In Greece, a strict accounting system was required of all public officials. These seem to have been unable to prevent graft which was very prevalent although severely penalized. Each officer upon leaving office, was required to render an accounting of funds and publicity was secured by engraving the accounting on stone and exposing it to public view. The Greeks borrowed much from the East and developed a crude clearing-house system.

In early Rome the father of a family kept records of receipts and payments in a sort of blotter or memorandum record. The system developed by the state in this early period introduced a new feature by means of which disbursements were safeguarded. The official intrusted with the funds had no authority for disbursing them. That was intrusted to a separate and distinct body which issued orders on the treasurer, providing him with a voucher, at an accounting time, for the disbursements made by him.

Through these and similar devices of early record keeping, business has gradually refined its rough drafts and kept the best ideas, though with varying changes in detail from time to time.

The simplified invoice is the outgrowth of two previous forms, resulting from the unification of the standard and uniform forms, and allows both unit or multiple billing. It was endorsed by a joint committee, representing the supporters of both these older forms, at a meeting held under the auspices of the Division of Simplified Practice of the Department of Commerce, in Washington, D. C., on February 16, 1927. It has since been accepted by 44 associations and 628 individual companies.

Because of the consistent demand for this information, it is believed that this article will be of interest to readers.

Requirements of Modern Forms

Modern management requires that business documents measure up to five principles of form design. These are:

1. Adaptability to purpose.
2. Ease of use.
3. Economy in printing.
4. Economy in equipment.
5. Uniformity.

Let us apply this yardstick of measurement to the simplified form. First we shall try *adaptability to purpose.* The simplified invoice is handled by both buyer and seller, and both should be considered. Since it becomes a permanent record of the buyer, his interests must be recognized as an important factor. A narrow viewpoint or personal whim can not be reconciled with adaptability for both parties. Rather, study must be given to the course of the invoice, its origin, its being checked, recorded, mailed, received by buyer and consequent routine. The location of information on the sim-

plified invoice form is arranged and based on its adaptability to both buyer and seller. The "customer's use" block must be exactly as shown with none of the designations omitted. The standard sequence and position of designations must be followed. The size and arrangement of space for vendor's name, address, trade mark, etc., may be changed in certain prescribed ways. The spacing, both horizontal and vertical to the left of "customer's use" block may be changed. The "shipped to and destination" line may be arranged for the window envelope. The "quantity," "description," "price," and "amount" columns may be sub-divided if desired. Invoices to retailers may provide a 7/8-in. column to the right of the "amount" column and headed "for retailer's use." The majority of invoices issued on the simplified invoice form cover l.c.l. shipments, proving its applicability to carload or less carload billings. Both buyer and seller should have a part in determining that this instrument is adequate for all usual requirements. Since this form was agreed upon by a large and representative portion of all industries, surely it fulfills the requirement of adaptability to purpose.

The simplified invoice was the outgrowth of two previous forms, resulting from unification of the standard and the uniform forms, and allows both unit or multiple billing. It was endorsed by a joint committee, representing the supporters of both of these older forms, at a meeting in Washington on February 16, 1927, held under the auspices of the Division of Simplified Practice of the Department of Commerce. It has since been accepted by 44 associations, 28 of which had a total membership of 44,564, according to a 1926 survey. It has also been accepted by over 628 individual companies.

The second requirement is *ease of use.* This principle applies to size, arrangement, and method of filing. The form must be large enough to provide ample space for entering information, yet not so large as to be unwieldy or wasteful. The simplified form is 8½ in. wide, or the standard letter-size width. The length may be 7 in., 11 in., or 14 in. These uniform dimensions permit the use of standard filing units.

Regarding ease of use, may I quote what one large railroad has to say: "Uniformity of information enables various people who handle invoices to do it more quickly, as there is only one place for order number, terms, F.O.B. price, receipt of materials, etc., which saves considerable time in checking and handling the invoice. An employee once familiar with a single invoice is better able to handle invoices with more accuracy and dispatch as information is shown at the same place on each invoice. This also applies to the shipper when making up the invoice, as to information that must be shown." More about ease of use will be explained later.

The third requirement is *economy in printing.* Each form, especially if used in considerable quantities, must be designed to obtain maximum economy in printing. In general, this is secured by (a) adopting a standard size which will permit printing a number of forms at one set-up; (b) by reducing amount of typed matter; (c) by using standard type, and (d) by judicious selection by method of ruling. The simplified form can be cut from standard stock sheets without waste, it can be printed in large quantities at one set-up, captions have been supplied to reduce typed matter to a minimum, it can be printed with standard type and judicious selection has been made as to the ruling. It has been stated by those in a position to know that general use of this form will save industry $15,000,000 yearly. A portion of this will be saved both in printing and paper. One large printer and supplier of these forms has stated that the savings effected by the set-up and printing of this form is passed on to the buyer, in the form of better printing at lower prices. Many printers and suppliers are now printing, stocking, and advertising the simplified invoice form.

The fourth requirement is *economy in equipment.* This principle is obtained through proper design. It is necessary to use standard sizes to secure economy in the purchase of new filing equipment. If existing filing equipment is available and taken into consideration when forms are designed, additional purchases may be unnecessary. The simplified invoice was designed after careful study of conditions and with a vision of the future. It has been in existence and use for over two years and is becoming increasingly popular. Many companies contemplate using the simplified invoice as soon as the supply of their present individual forms is exhausted. Many printers have already expressed a willingness to carry stocks of the simplified form.

The fifth requirement is *uniformity.* All forms used by an organization should be uniform so far as possible. In this case two groups are involved; that of the seller and that of the buyer and both should be considered. The various items on the simplified invoice follow one another in the sequence in which the information to be entered is usually obtained and entered. When the information to be entered comes from several different sources, such as the purchase order, shipping papers, etc., clerical time is saved and chances for error are lessened when all items from each source can be entered systematically. This form when filled-in preserves an adequate, accurate, immediate and reliable record.

An invoice form may be perfect from the viewpoint of the seller but cumbersome and costly for the purpose of the buyer. It is peculiar in this modern trend of business that buyers, in many cases, have to furnish their suppliers with the simplified form. It is a buyer's right to insist on a form which becomes his permanent record. In the final analysis, the buyer pays the overhead and is entitled to some consideration of a form which will save his company both time and money. Picture the buyer's dilemma when the information is scattered all over the invoice, which measures

from "postage stamp" to "table cloth" dimensions. How much thought is given the beautiful display of the seller's advertising, when this situation exists? The simplified invoice helps eliminate this particular irritation from business and does away with wasteful methods.

One example is cited of what a foreign company is doing. The Canadian National Railways signified its preference for the simplified form almost immediately upon its inception and has backed up its enthusiasm with practical work. They are continually writing their suppliers and have obtained satisfying results. Approximately 60 per cent of their incoming invoices conform to the simplified invoice.

Results of a Recent Survey

Results of a recent survey are interesting and enlightening. The survey covered a period of 8 months and 313 reports were received from 28 states including the District of Columbia. The average degree of adherence of incoming invoices was 17.07 per cent.

The steam roads are evidently working zealously for the simplified invoice. The average adherence as covered by their 10 replies is 52.08 per cent, which is the highest of any group reporting. The railroads are to be congratulated on such a splendid showing. While this record of adherence is so gratifying, acceptances covering the simplified form have only been received from 40 per cent of those roads reporting. Much can still be done in getting the railroads on record, as using this form —that is to "sign an acceptance."

Forty-six reports were received from other public utilities including light and power, electric railways, gas, water, bus companies, etc. There has only been one acceptance received from these forty-six companies although many of them undoubtedly have adopted this form. Seventy-four public utility companies including railroads have signed acceptances. Their adherence is 18.64 per cent, which is higher than the general average. The steam roads and these public utilities represent large users of materials and receive hundreds of thousands of invoices from all classes of industries. These adherence figures and the comments of these groups should therefore be a fair measure of the adoption and popularity of the simplified form.

Of 257 companies reporting by name, 235 or 91 per cent have not sent in acceptances although all invariably told how they were benefiting or would benefit by the general adoption of the simplified form. The results of this survey lead to but one conclusion and that is:

The buyer has departmentalized the benefits of the simplified invoice form in his company. In other words, he has limited the knowledge of its advantages to his own immediate staff and has not sold his company on the benefits of issuing their invoices on the simplified form.

How can this project be more successful if the buyer insists on the simplified form, yet his own company refuses to issue it? A letter from one association stated that of its 71 members, only one used this form. A large oil company wrote us stating that not a single invoice reached them on the simplified form over a period of 60 days.

If it is true that none of us want to buy from a salesman who isn't sold on his own product, then how can it be expected that the executives of these companies will be sold on this proposition unless the buyers convince them? The Division of Simplified Practice is always ready to help by supplying information, data and talks on the subject, whenever such can be judiciously and economically arranged. The detailed results of this recent survey can be obtained in mimeographed form, upon request.

Future Possibilities

The acceptors of this form represent a true cross section of all general classes of industry, proving that the invoice can usually be adapted to nearly all business.

Even though all the information is not used all the time, the convenience of having a fixed or uniform arrangement greatly outweighs the disadvantage (if such proves to be in some cases) of excess captions.

It must be remembered at all times that the simplified form is the result of careful study of all conditions and was designed to meet the requirements of the greatest number. The degree of savings effected will be determined by its general adoption. It may not meet the exact requirements of a business but it is emphasized that it has met the requirements of hundreds of businesses and a little investigation may prove that your competitors or kindred industries are themselves on the list of those who are already using the form.

A prominent lawyer of the New York Bar says, "Every department of a concern, including its legal staff, can harmonize into the plan (simplified practice) with practically no expense and trouble, and much litigation could thus be effectively avoided. The purpose of the Department of Commerce plan is simplification, not standardization. As such it is a valuable contribution toward litigation prevention."

General use of the simplified invoice should tend to reduce confusion and misunderstandings as all concerned would then be familiar with its captions and corresponding information.

Its general use will help reduce the cost of clerical help. Clerks who become accustomed to finding the same information in the same place, time after time, should increase their speed in handling and checking. The simplified sizes will expedite routing and filing. Since the information is uniform, standard rules of procedure can be written and followed. This should be especially helpful to new clerks. Should clerks be transferred from the billing to the purchasing department or vice versa, they would not have to learn an entirely new routine. Or should employees be engaged who have had previous training in the billing or pur-

chasing departments of other organizations they could very quickly adjust themselves to their new positions without the usual "training period" expense.

Invoices are sometimes mistaken for other business forms and cases are not rare where invoices have been routed in error, due to improper identification. Such errors affect cash discounts. Due to the familiarity of those handling the simplified invoice, the routing would be expedited and such errors should not occur. This would have a tendency to help in discounting all invoices, within the required period.

Where special invoices are used, it is necessary to carry a stock in order to insure continuity of operation. This stock represents an investment, incurs an overhead in storage space and clerical control and represents a certain waste in handling. Printers and suppliers are in a position to print the simplified form during dull seasons and carry a stock at all times, insuring prompt delivery service.

In summarizing these further potential possibilities, which should result from the general adoption of the simplified form, we have:

1. Saves time in filing, finding and handling while being checked.
2. Paves the way for standard office procedure, thereby reducing cost of training new employees and transferring others.
3. Tends to eliminate misunderstandings and legal entanglements.
4. Avoids wrong identification of form causing loss of time and money.
5. Eliminates waste in paper by cutting from standard stock size.
6. Reduces stationery stock, thereby releasing storage space and reducing overhead expense.
7. Conserves filing space through uniformity of size.
8. Saves correspondence by including all necessary information on the forms themselves.
9. Saves time in mailing by being adapted for use with the window envelopes.
10. Conforms to the five requirements of a modern commercial form; namely, adaptability to purpose, ease of use, economy in printing, economy in equipment, and uniformity.

President Hoover, in his inaugural address, said that "our people have in recent years developed a new found capacity for cooperation among themselves to effect high purposes in public welfare," and that "progress is born of cooperation in the community—not from political restraints." "The government should assist and encourage these movements of collective self help by itself cooperating with them. Business has by cooperation made great progress in the advancement of service, in stability, in regularity of employment and in correction of its own abuses." The Division of Simplified Practice is founded upon this thought and is striving to "assist and encourage these movements of collective self-help by itself cooperating with them."

A large business service company recently headed their advertising—"Every invoice—pictures your organization." A hundred or a thousand invoices go out and leave their impressions on your trade. Does any company want that impression to be one of lack of cooperation, refusal to adopt methods which would help the greater number of all concerned, and failure to keep pace with the forward march of progress?

A great number of sellers have adopted the simplified form, due to requests from the buyers. When the sellers learn that the buyers' organizations are not sending out billings on this form, they naturally bring up the point that "what is sauce for the goose is sauce for the gander." They are right. That is a logical issue. Every buyer who realizes the advantages of this form and insists upon its use (and he has a right to do so), should "sell" the simplified form to his own organization. Such action will anticipate the present issue of the seller and will in a larger sense, assure greater benefits and savings for a greater number of organizations.

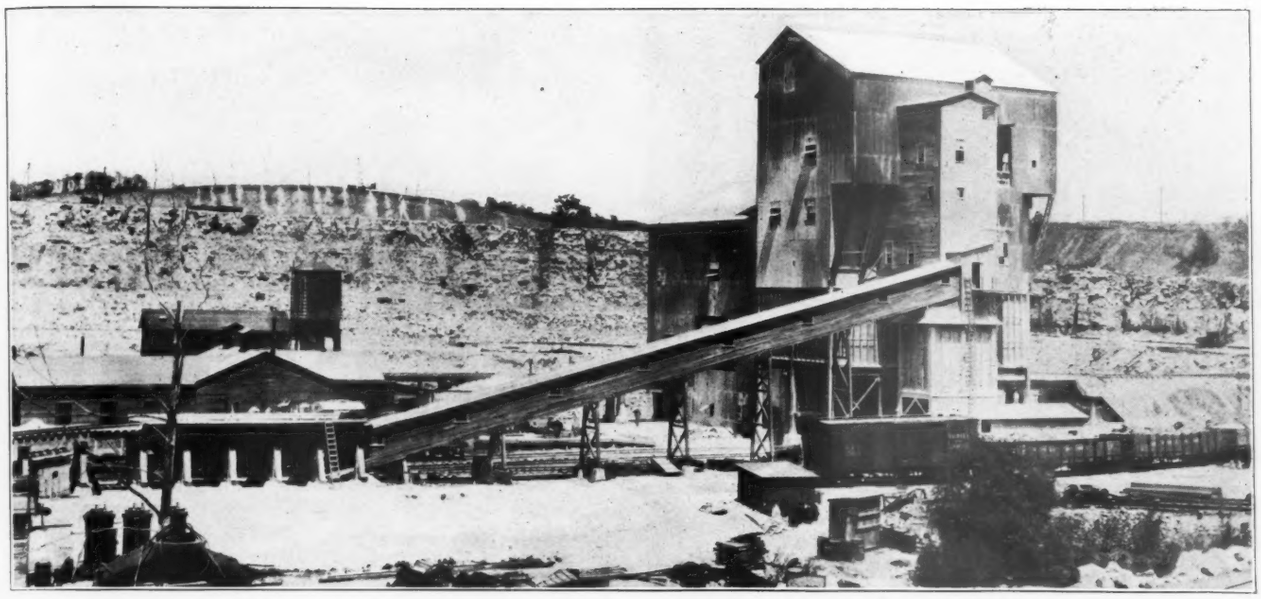
Piedmont District Largest Producer of Non-Metallic Minerals in Italy

During 1929 Italy had a total production of 3,600 tons of asbestos, Piedmont alone producing 3,000 tons. Asbestos from this district is obtained almost entirely from the mines at Balangero and is consumed locally in the manufacture of asbestos boards. In addition to the domestic production Italy imported 13,904 tons of asbestos during the year, of which about two-thirds entered Piedmont and was used in manufacture, principally of asbestos textiles. These imports, which came from Canada, were slightly below the 1928 figure of 14,-120 tons.

An output of 33,000 tons of talc in the Turin district in 1929 showed an increase over the 26,970 tons extracted in 1928. This represents almost the entire output for the whole of Italy, which is given as 34,600 tons in 1929. There was an increased exportation of talc in 1929, owing to the good quality obtained. The domestic consumption was chiefly in connection with the manufacture of paper, rubber goods, soaps and powders, and in polishing rice.

Graphite production showed a decrease from 7,250 tons in 1928, to 6,050 in 1929. The entire output was from Piedmont. It is reported that the decrease in output was due to the smaller demand on the part of the domestic consumers, who are reducing manufacture on account of the industrial crises. There was also a decrease in exports from 4,376 tons in 1928 to 3,824 in 1929.

The 1929 production of 2,000 tons of gypsum in Piedmont was the same as that for 1928, and the entire output was consumed locally.



General View of Plant No. 1 at Krause, Ill.

Producer of Crushed-Stone Operates Own Material Yards at St. Louis

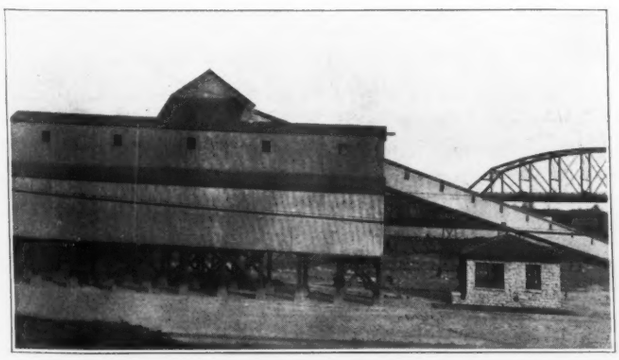
Recent Expansion Program Also Included Improvements to Firm's Producing Plants

THE Columbia Quarry Co., one of the largest producers of crushed stone in the St. Louis district, early this spring made some changes in its plants at Krause and Valmeyer, Ill., and put into operation two distributing plants, one in St. Louis, Mo., the other in East St. Louis, Ill. These are so located as to serve those parts of the city in which the most construction work is being done.

Yard No. 1, as the new East St. Louis yard is called, is located at the Illinois end of the free bridge spanning the Mississippi River at this point. The yard is located on a switch track of the Illinois Central Ry., over which material is brought from the company's plant at Krause, which is about 12 miles to the south.

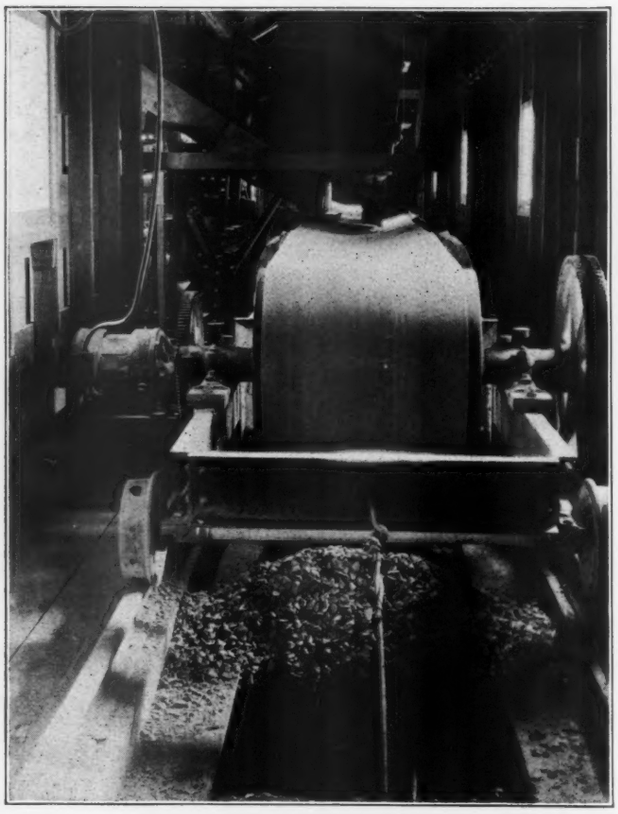
The cars of crushed stone are discharged into a 25-ton-capacity steel track hopper, hopper-bottom cars only being used. This discharges through a gate onto a 24-in. inclined belt conveyor on 36-ft. centers which feeds at an angle onto another 24-in. inclined conveyor on 250-ft. centers to the top of the bins. Both of these conveyors are enclosed with Armco corrugated metal siding and roofing and are supported on structural-steel framework with concrete footings.

The main conveyor discharges through a chute onto a 24-in. cross-conveyor on 17-ft. centers which, in turn, feeds a 30-ft. shuttle conveyor. This discharges to any of five bins with a capacity of 100 tons each. Additional material can be stored in



View of Yard No. 1 and office, East St. Louis. Highway in foreground.

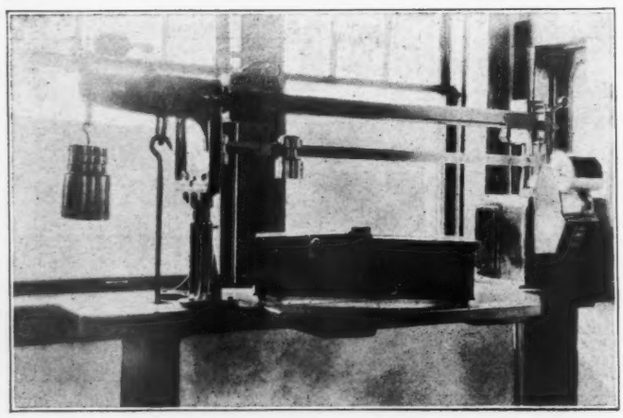
Another view of the yard with car-unloading hopper in foreground.



Shuttle conveyor over bins at East St. Louis Yard No. 1.

three smaller bins with a capacity of 30 tons each. Discharge is to trucks through Stephens-Adamson quadrant gates controlled from the ground by levers.

The main plant and bins are of timber construction with concrete foundations and have Armco 28-gauge corrugated metal siding. The main conveyor has a gravity takeup and is gear-driven at its head by a 25-hp. Westinghouse motor. The cross conveyor is driven by a 5-hp. motor, also of the same make. The shuttle conveyor is reversible and this feature, together with its lateral movement which is controlled by gear and cable, allows the conveyor to discharge to any of the five large bins. The three small bins are loaded direct from the main conveyor. Stephens-Adamson belt conveyors with Saco belting are used. Operations are controlled by Square D, Westinghouse and Bulldog safety switches.



Scale and sight-reading device in office at Yard No. 1.

George Schoening, foreman, in front of office at Yard No. 1, East St. Louis.

Wide concrete runways connect the bins with the office and the street. The office is an unusually attractive building of natural stone from the company's quarries. It has a green tile roof and is finished inside with stucco. Truckloads are weighed on a Howe scale with a Weightograph attachment. Geo. Schoening is in charge of this plant, which has a capacity of 600 tons per day.

The second yard operated by the Columbia Quarry Co. is at 3722 N. Broadway, St. Louis. This serves the northern part of the city, a large part of which is a prosperous industrial district. This is not a new plant, but was converted from buildings erected for other purposes.

The changes in plant No. 1 at Krause, Ill., consisted of the installation of four new 4-ft. by 8-ft. Niagara double-deck vibrating screens. These screen material from 1½-in. down and replace six revolving screens. A fifth vibrating screen, also a Niagara, will soon be installed to handle the material under 1-in. from the scalping screen. At the Valmeyer, Ill., plant one 4-ft. by 8-ft. Niagara double-deck, vibrating screen replaced a revolving screen. These installations were made not only to increase the capacity of these plants but to improve the product as well. A complete description of the Valmeyer plant may be found on page 57 of the June 18 issue of PIT AND QUARRY.

Largest Quantity of Magnesite Mined Last Year Since 1920

The total quantity of crude magnesite mined in the United States in 1929 was 187,660 short tons, with an approximate value of $1,500,000, according to reports furnished by producers to the United States Bureau of Mines, Department of Commerce. This represents the largest quantity mined since 1920 and was an increase of 47.5 per cent over that reported in 1928, which was 127,200 short tons. There were 4 operators in California, working 4 mines, one each in San Benito, Santa Clara, Stanislaus and Tulare counties, and one at Chewelah, Stevens County, Wash.

A Study of the Cost of Quarrying Trap Rock, Sandstone and Granite

By J. R. THOENEN
Mining Engineer, U. S. Bureau of Mines

DURING 1928 questionnaires covering the calendar year 1927 were sent to over 1,700 quarries producing stone for purposes other than cutting to dimension. These included producers of stone for lime burning, cement manufacture, rip rap, and crushed stone. The various kinds of stone represented were limestone, trap rock, sandstone, granite, and marble.

Replies received from limestone producers prior to November, 1928, were compiled into tables and published in February, 1929, as a preliminary report (Bureau of Mines Report of Investigation 2911).

The present paper summarizes the final tabulations of costs of (1) trap rock, (2) sandstone, and (3) granite quarries. It is regretted that the figures presented do not cover a larger number of quarries, because the greater the number of similar plants presenting data to be averaged, the greater the value of the averages. If more producers had cooperated the figures would more nearly represent averages and costs for the country as a whole, but since the detailed costs of even a single quarry are of value to other operators as a means of checking efficiency at each step, the writer believes the data are well worth publishing and wishes to take this opportunity of extending his thanks to the companies who contributed the information that make possible even this incomplete cost study.

Trap-Rock Quarries

Trap rock as covered in this circular is defined as that rock commonly called "trap" by stone producers. The author realizes that there are various kinds of rock designated as "trap" by the trade which do not conform to the same mineralogic definitions. Although separation according to these differences in physical characteristics might increase or lower production costs, there is not sufficient information at hand to differentiate, and they are combined in order to present a maximum of cost detail.

Complete or part replies were received from 27 trap-rock quarries representing plants in 13 states, scattered from California to Connecticut and from Minnesota to Georgia.

Of these 27 reports, 21 were sufficiently complete to compile into tabular form, and parts of the others have been used in those parts of the report wherein their information was pertinent. Some of the detailed costs which are totally out of line with the averages have not been used to make up the final tabulations.

Recognizing that the size of the quarry operation has an important bearing on the ultimate cost of operation, the quarries have been grouped in various combinations as shown in the tables.

The purpose for which the stone is prepared may also affect final costs, but in the case of trap rock all but one reported their major product as crushed stone, hence there is no differentiation in the tables by uses. The one exception was a quarry which had no crushing equipment because it produced stone exclusively for rip rap.

In those tables dealing with the details of operating steps as much information is presented as is possible without divulging the costs of any individual operator. Some costs of an individual operation, needed for comparative purposes, are given in percentages of the operating and total costs.

There are so many and such varied angles from which to approach the subject of crushed stone costs that a word of caution is advisable prior to the study of the following tables.

1. The following costs are based upon the tonnage of material sold. In many plants an appreciable tonnage of material produced is not marketable and is wasted. The cost of production in this case if calculated against the total production would be correspondingly lower than where only the product sold was considered. Nevertheless, such a cost would be truly a production cost.

2. The tables represent costs for the total tonnage sold, irrespective of the market value of the separate grades. Crushed stone is sold under innumerable size specifications and combination of sizes. In certain parts of the country the smaller

TABLE 1—TRAP-ROCK QUARRY PERCENTAGE COSTS

Tons produced daily	0—199		200—499		500—999		1,000 & up	
Method of Loading and Cost Details	Operating Cost	Total Cost	Operating Cost	Total Cost	Operating Cost	Total Cost	Operating Cost	Total Cost
Hand-Loading: Number of quarries	3		3		1		1	
Wage cost	59	43	47	38	56	43	57	39
Quarry cost	74	54	63	50	85	65	90	60
Crushing and screening cost	26	20	37	30	15	11	10	7
Total operating cost	100	74	100	80	100	76	100	67
Overhead cost	.....	26	.....	20	.....	24	.....	33
Total cost	.....	100	.....	100	.....	100	.....	100
Shovel-Loading: Number of quarries	.....		3		6		6	
Wage cost	.....	.....	50	25	47	34	42	25
Quarry cost	.....	.....	67	33	59	35	68	41
Crushing and screening cost	.....	.....	33	16	41	25	32	19
Total operating cost	.....	.....	100	49	100	60	100	60
Overhead cost	.....	.....	.....	51	.....	40	.....	40
Total cost	.....	.....	.....	100	.....	100	.....	100

sizes down to one-fourth inch command a price premium. In other sections the larger sizes are the higher priced. Obviously the more time and energy spent upon a product the greater will be its cost of production. The smaller sizes of stone are more expensive to produce because of greater crushing, screening, and handling charges. On the other hand, in the majority of localities there are more of the smaller sizes made by producers than the market will absorb. This makes them a waste product which the operator is often anxious to move even at a price below his actual cost. Even where all sizes of stone are sold at the same price the smaller sizes may be selling below cost, although the larger sizes bring a profit.

It must therefore be borne in mind that the cost figures which follow are based on total sales tonnage irrespective of size or other special preparation.

Table 1 presents the costs of 23 quarries in percentages.

The wage cost as shown therein is compiled from the total number of employees, the average rate of pay, and the total annual production. The quarry cost represents all operating costs, including stripping, drilling, blasting, loading, and transportation from the quarry to the crushers and in some instances some minor miscellaneous costs chargeable to the quarry operation. Crushing and screening costs include all operating costs connected with crushing, screening, elevating, storage, and truck or car loading.

The quarrying, crushing and screening costs added together represent the total operating cost as shown.

The overhead costs comprise such items as depletion, royalty, depreciation, interest on capital investment, taxes, and various others such as insurance, sales expense, etc., listed as miscellaneous overhead.

Inasmuch as quarry operations may be divided into the two general methods of hand and power-shovel loading, this differentiation is also made in the table.

Percentages are shown on both operating and total costs.

Table 2 presents the actual costs of 21 quarries grouped on the same basis of production size and method of loading as in Table 1. The costs represent the same items as defined in Table 1, and the two individual quarries shown in Table 1 are necessarily omitted to avoid exposing their costs.

TABLE 2—TRAP-ROCK QUARRY COSTS

Loading Method and Daily Production	Number of Quarries	Average Wage per Man-Hour	Average Total Labor Cost per Ton	Average Quarry Cost per Ton	Average Crushing and Screening Cost per Ton	Average Total Operating Cost per Ton	Average Total Overhead Cost per Ton	Average Total Cost per Ton
0—199 tons:								
Hand-loading.	3	$0.41	$0.59	$0.74	$0.26	$1.00	$0.36	$1.36
200—499 tons:								
Hand-loading.	3	.57	.46	.61	.36	.97	.24	1.21
Shovel-loading	3	.60	.44	.58	.30	.88	.90	1.78
500—999 tons:								
Shovel-loading	6	.53	.33	.41	.29	.70	.47	1.17
1,000 tons and over:								
Shovel-loading	6	.57	.21	.34	.16	.50	.33	.83

It is interesting to note that the total cost in the three hand-operated quarries of the second group size is lower than that for the shovel-operated quarries of the same group. This is due directly to the difference in overhead costs. A production of less than 500 tons daily is probably small for shovel operation, which possibly accounts for the higher overhead charges.

Singularly enough, the one hand-operated quarry shown in the third group in Table 1 has a total cost per ton less than the average for the six shovel-operated quarries in that group due to lower overhead and crushing costs. Also only one of the six shovel-operated quarries shows a lower total cost than this one hand operation.

Cost Details

Although all of the quarries shown in Table 2 returned costs in the detail shown, not all of them returned costs for each of the contributing operating steps. Therefore Table 3 will not present figures that can be totaled to equal the corresponding columns on Table 2. In each case the number of quarries reporting is given, from which the average figures shown in the table are computed. In presenting detailed operating costs the figures are

Table 3. TRAP-ROCK QUARRY OPERATING COST DETAILS

Loading Method and Daily Production	Average Stripping Cost		Average Drilling Cost Per Ton Stone	Average Blasting Cost Per Ton Stone	Average Loading Cost Per Ton Stone	Average Transportation Cost Per Ton Stone	Average Storage Cost Per Ton Stone	Average Crushing Cost Per Ton Stone	Average Other Operating Cost Per Ton Stone	Average Total Operating Cost Per Ton of Stone from Table 2
	Per Cu. Yd. Overburden	Per Ton Stone								
0—199 tons:										
No. quarries reporting	2	2	2	1	2	1	.....	2	.....	3
Hand-loading	$0.48	$0.07	$0.12	$0.10	$0.12	$0.07	.....	$0.30	.....	$1.00
200—499 tons:										
No. quarries reporting	1	1	2	3	2	2	1	2	3	3
Hand-loading	.38	.02	.15	.09	.17	.07	.16	.44	.03	.97
No. quarries reporting	1	2	3	3	3	2	2	3	.....	3
Shovel-loading	1.00	.11	.16	.10	.10	.07	.13	.27	.....	.88
500—999 tons:										
No. quarries reporting	4	3	6	5	6	6	4	5	1	6
Shovel-loading	1.22	.09	.11	.12	.11	.07	.04	.15	.07	.70
1,000 tons and over:										
No. quarries reporting	5	3	4	4	4		2	5	3	6
Shovel-loading	1.19	.03	.08	.05	.18		.06	.11	.05	.50

Table 4. TRAP-ROCK QUARRY OVERHEAD COST DETAILS

Loading Method and Daily Production	Average Depletion or Royalty Cost Per Ton Stone	Average Depreciation Cost Per Ton Stone	Average Interest Charge Per Ton Stone	Average Tax Charge Per Ton Stone	Average Miscellaneous Overhead Charge Per Ton Stone	Average Total Overhead Charge Per Ton Stone from Table 2
0—199 tons:						
No. quarries reporting	3	1			1	3
Hand-loading	$0.11	$0.20			$0.37	$0.36
200—499 tons:						
No. quarries reporting	1	3	1	2	2	3
Hand-loading	.01	.07	.05	.02	.11	.24
No. quarries reporting	1	1	1	1	3	3
Shovel-loading	.18	.32	.06	.01	.72	.90
500—999 tons:						
No. quarries reporting	4	6	4	5	6	6
Shovel-loading	.05	.15	.06	.03	.20	.47
1,000 tons and over:						
No. quarries reporting	2	5	5	5	4	6
Shovel-loading	.02	.10	.10	.02	.14	.33

used as returned by the operators. The questionnaire stated clearly that no overhead costs were to be included. Because of the different methods used by various individuals in calculating overhead costs, there will be a considerable range in overhead costs, as is shown by the tabulation.

The quarry operator often desires to know what tonnage can be produced per unit of labor. Table 5 has been compiled with this end in view. It is not possible to obtain a direct comparison per man employed, because at some plants the day is 8 hours whereas at others it is 9 and sometimes 10 hours. Therefore the unit taken is the man-hour. This unit has been obtained by multiplying the average number of men employed by the hours per day and the days operated annually, and dividing this product into the annual production.

In order to present other comparable data, columns have been added which may influence the result. The same unit size groups are retained as in the preceding tables.

Stripping

The details of costs on overburden removal were not sufficiently complete to draw definite conclusions. One reason for this is that many producers reported no stripping, but that they separated the stone and dirt on the quarry floor. The results as compiled from the returns are presented in Table 6.

Drilling

Drilling costs at practically all trap-rock quarries may be subdivided into two general classes: Primary—covering that operation designed to break the rock from the solid; and secondary—covering the breaking of boulders to handling-size after the initial quarry shot.

Churn, piston, and hammer drills are used in primary drilling, but the hammer drill is practically the only tool used in secondary drilling. The number of quarries using piston drills was not sufficient to tabulate without exposing individual figures.

High benches are broken with churn drills, whereas the piston and hammer drills cut lower benches, but these often are arranged in such manner as to bring down a high face in a succession of steps. Obviously the single and multiple bench method of drilling will present different operating problems, and drilling costs have been segregated on that basis.

Some questionnaire replies gave the cost of drilling per ton of stone broken, but did not state the cost of drilling per foot of hole. In such cases the tonnage broken per foot of hole has been calculated from the data given as to depth and spacing of holes, using 175 lb. as the weight per cubic foot of trap rock. In other cases the cost per foot was given, but no cost per ton, and a similar calculation has been made. (Table 7.)

Realizing the effect that size of quarry operation and height of face have on drilling costs, the average daily production and height of face are shown for each group. Also the average length of the holes is given a separate column in the table, for in many instances, holes are drilled below the quarry floor to insure bringing out the toe.

In order to determine the relation between the

Table 5. TRAP-ROCK QUARRY PRODUCTION

Daily Production	Loading Method *H = Hand S = Shovel*	Average Wage Per Man-hour (*Dollars*)	Days Worked Yearly	Average Height of Quarry Face (*Feet*)	Average Production in Tons Per Man-hour				Average Operating Cost Table 2	Average Total Cost Table 2
					In Quarry	In Crushing Plant	In Other Labor	In Total Plant		
0—199 tons:										
No. quarries reporting		3	3	3	3	2	1	2	3	3
	H	$0.41	154	73	1.0	4.7	1.6	0.8	$1.00	$1.36
200—499 tons:										
No. quarries reporting		3	3	3	2	2	2	3	3	3
	H	.57	217	76	2.4	18.0	3.0	1.9	.97	1.21
No. quarries reporting		3	3	2	3	2	2	3	3	3
	S	.60	244	83	2.1	6.0	6.8	1.6	.88	1.78
500—999 tons:										
No. quarries reporting		6	6	6	6	6	5	6	6	6
	S	.53	227	118	3.5	8.3	7.5	1.7	.70	1.17
1,000 tons and over:										
No. quarries reporting		6	6	5	5	5	5	6	6	6
	S	.57	203	160	11.7	11.1	5.6	2.8	.50	.83

Table 6. TRAP-ROCK QUARRY STRIPPING COSTS

Method of Overburden Removal	Average Daily Stone Production, (*Tons*)	Average Thickness of Overburden, (*Feet*)	Average Height of Quarry Face, (*Feet*)	Average Length of Waste Haul, (*Feet*)	Average Cost Overburden Removal per Ton Stone	Average Cost Overburden Removal per Cu. Yd. per 100-Foot Haul	Average Operating Cost per Ton Stone	Per Cent of Operating Cost for Stripping	Average Total Cost per Ton Stone	Per Cent of Total Cost for Stripping
Hand and wagon	385	3.6	63	525	$0.045	$0.125	$0.88	5.1	$1.22	3.7
Hand and truck	800	12.0	185	500	.02	.16	.80	2.5	1.05	1.9
Drag scraper	455	13.0	65	156	.01	.66	.90	1.1	1.53	0.6
Power shovel and truck	1,180	8.6	118	550	.05	.28	.71	7.0	1.04	4.8
Power shovel and car	1,410	5.0	175	850	.03	.075	.52	5.8	.91	3.3

Table 7. TRAP-ROCK QUARRY DRILLING COSTS

Method of Drilling	Average Daily Stone Production, (*Tons*)	Average Height of Quarry Face, (*Feet*)	Average Depth of Holes Primary Drilling, (*Feet*)	Average Diameter of Holes Primary Drilling, Inches	Tons Stone Produced per Drill per Day		Tons Broken per Foot of Hole Primary	Tons Broken per Cubic Foot of Hole Primary	Average Cost per Foot of Hole Primary, (*Dollars*)	Average Drilling Cost per Cubic Foot of Hole, (*Dollars*)	Average Drilling Cost per Ton of Stone Broken			Average Operating Cost per Ton Stone	Per Cent of Operating Cost for Drilling	Average Total Cost per Ton Stone	Per Cent of Total Cost for Drilling
					Primary	Secondary					Primary	Secondary	Total				
Churn drills	1,046	131	120	6.7	416	222	50.0	206	$3.17	$13.05	$0.06	$0.08	$0.14	$0.68	21	$1.14	12
Hammer drills	282	66	18	2.0	129	160	4.9	224	.57	26.06	.07	.....	.11	.98	11	1.45	7.6
Churn drills	1,075	113	112	6.0	541	251	31.0	158	1.70	8.65	.05	.09	.14	.64	22	1.08	13
Churn drills	1,160	168	146	8.0	554	125	80.0	229	5.17	14.80	.05	.07	.12	.68	18	1.11	11

diameter of the hole drilled and the cost of drilling, calculations have been made showing tonnage broken per cubic foot of hole drilled. This calculation is made by dividing the tons broken per foot of hole by the volume of the hole per foot of length. It is interesting to note that although hammer-drill holes cost twice as much as churn-drill holes per cubic foot of volume, the hammer-drill hole seems to have a slight advantage in tonnage broken per unit of volume.

In the second section of the table a comparison is made between churn-drill holes of 6-in. and 8-in. diameters. Although the cost of drilling 8-in. holes is shown to average $5.17 per foot as against $1.70 for 6-in. holes, the primary drilling cost per ton is the same and total drilling cost is less for 8-in. holes. This would seem to indicate better fragmentation with the larger hole. The apparent difference between length of hole and height of quarry face shown in those quarries using 8-in. holes is explained by one quarry in this group cutting the stone in two benches. All others drilled holes from 5 ft. to 10 ft. below the quarry floor.

It is also of interest that where 1 cu.ft. of hole 8 in. in diameter accounted for 229 tons, the same volume of 6-in. hole produced only 158 tons.

In considering drilling costs the depth of the holes must not be lost sight of, for the last few feet in the bottoms of the holes are the most expensive, and where the 8-in. holes averaged 146 ft. in depth, the 6-in. holes averaged 112 ft.

Unfortunately only a few quarries using hammer drills reported their primary drilling costs, and only one reported the secondary cost. Several reported the total cost which is averaged as shown.

There was not sufficient data contained in the replies to make comparisons of drilling cost based on the type of power used by the drill.

Loading

Unfortunately there were not sufficient details in the returns to differentiate and make comparisons of the duty performed by shovels of different type and power. Many operators reported the type of shovel used, as railway, traction, or caterpillar, but neglected to state the kind of power

Table 8. TRAP-ROCK QUARRY BLASTING COSTS

	Average Daily Stone Production, (*Tons*)	Average Height of Quarry Face, (*Feet*)	Average Depth of Drill Holes, (*Feet*)	Average Diameter of Drill Holes, (*Inches*)	Tons Broken per Pound Explosive			Average Blasting Cost per ton stone			Average Operating Cost per Ton Stone	Per Cent of Operating Cost for Blasting	Average Total Cost per Ton Stone	Per Cent of Total Cost for Blasting
					Primary	Secondary	Total	Primary	Secondary	Total				
Churn drills	1,046	131	120	6.7	(2)	(2)	4.5	$0.06	$0.04	$0.10	$0.68	15	$1.14	9
Hammer drills	282	66	18	2.0	.....	.....	(1)2.5	.....	.....	(1) .11	.98	11	1.45	8
Churn drills	1,075	113	112	6.0	(2)	(2)	(2)	.04	.03	.07	.64	11	1.08	6
Churn drills	1,160	168	146	8.0	(2)	(2)	(2)	.03	.05	.08	.68	12	1.11	7

(1) Average of two quarries only.
(2) Insufficient data to complete these columns.

Table 9. TRAP-ROCK QUARRY LOADING COSTS

Details of Operation	Average Daily Stone Production, (*Tons*)	Average Height of Quarry Face, (*Feet*)	Average Loading Cost per Ton Stone	Average Operating Cost per Ton Stone	Per Cent of Operating Cost for Loading	Average Total Cost per Ton Stone	Per Cent of Total Cost for Loading
Hand-loading after hammer drills	167	71	$0.125	$0.96	13	$1.26	10
Shovel-loading after churn drills	904	133	.11	.70	16	1.22	9
Shovel-loading with dippers of 2-cu. yd. capacity and under	794	117	.11	.74	15	1.23	9
Shovel-loading with over 2-cu. yd. dipper capacity	1345	198	.085	.56	15	1.15	7.4

used and vice versa. Others listed the size of the dipper but did not state the number of shovels employed. Also, although many reported their loading cost some combined it with the cost of transportation so that it was impossible to segregate them. As a result the loading costs can not be shown in as great detail as desired.

Table 3 shows average loading costs as applied to hand or shovel loading and tonnage produced daily.

Table 9 shows such segregations as are possible from the returns.

Transportation

By transportation is meant the movement of stone from the quarry face to the crushing plant. Cost comparisons are tabulated on the basis of equipment used. This varies from the simple hoist with cable reaching to the quarry face, to the more complicated haulage systems involving 30-ton locomotives and 12-cu.yd. capacity standard-gage cars.

Table 10 presents hauling costs in such detail as the replies permit. Owing to the manner in which several replies presented combined loading and transportation costs, Table 11 has been computed to present further comparison.

Crushing

The prevailing custom among trap-rock producers is to employ jaw crushers as initial breakers. Second-stage reduction is accomplished in most cases by gyratories, although some operators prefer the jaw type for all breaking. In some of the larger installations third or fourth stage reduction is obtained by gyratories, cone, or disk crushers, and in one instance the use of rolls was reported.

In Table 3 the crushing costs are shown segregated into groups with relation to size of daily production. Of the first group producing less than 200 tons daily, 75 per cent of those reporting showed no secondary crushing, the product from the initial breaker constituting the sales product. The majority of these plants used small jaw crushers. Those employing secondary breaking used gyratories for both initial and subsequent crushing.

In the second group producing from 200 to 500 tons daily, all but one plant used jaw crushers for first reduction, while secondary breaking was divided equally between jaw and gyratories. Half of these producers used crushers with less than 24-in. square openings, and the rest used large equipment.

The third group with from 500 to 1,000 tons daily production was 75 per cent equipped with jaw crushers as initial breakers; all the crushers had 24-in. or larger square openings. For secondary breaking 50 per cent used jaw crushers exclusively or in combination with gyratories, 50 per cent used gyratories, and one operator em-

Table 10. TRAP-ROCK QUARRY TRANSPORTATION COSTS

Hauling Method	Loading Method *H = Hand S = Shovel*	Average Daily Stone Production, (*Tons*)	Range in Weight of Locomotive, (*Tons*)	Range in Car Capacity, (*Tons*) (*1 cu. yd. = 1½ ions*)	Average Transportation Cost per Ton Stone, (*Dollars*)	Average Operating Cost per Ton Stone	Per Cent of Operating Cost for Transportation	Average Total Cost per Ton Stone	Per Cent of Total Cost fo transportation
Wagons	*H*	100	.....	.....	$0.07	$0.91	7.7	$1.34	5.2
Auto truck	*S*	680	.....	2–3	.10	.75	13.	1.45	7
Hoist and cable	*S*	800	.....	3	.05	.99	5	1.23	4
Gasoline locomotive	*S*	1250	3–3½	1½–4	.075	.62	12	1.00	7.5
Steam locomotive	*S*	733	14–26	4–18	.03	.56	5.4	.94	3.2

Table 11. TRAP-ROCK QUARRY COMBINED LOADING AND TRANSPORTATION COSTS

Loading and Transportation Details	Average Daily Stone Production (*Tons*)	Average Height of Quarry Face (*Feet*)	Range in Size of Dipper Capacity (*Cu. Yd.*)	Range in Weight of Locomotive (*Tons*)	Range in Car Capacity Tons (*1 Cu. Yd. = 1½ Tons*)	Average Loading and Transportation Cost Per Ton Stone	Average Operating Cost Per Ton Stone	Per Cent of Operating Cost for Loading and Transportation	Average Total Cost Per Ton Stone	Per Cent of Total Cost for Loading and Transportation
Hand-loading and hand transportation	683	70	.....	.....	1.5–3	$0.24	$0.94	25.5	$1.26	19
Hand-loading and wagon transportation	190	37	.....	.....	.....	.25	.89	28	1.19	21
Shovel-loading and auto truck haul	650	136	3–4	.....	2–3	.22	.75	29.3	1.45	15
Shovel-loading and railway haul	1166	130	¾–6	3–26	1.5–18	.16	.56	28.6	.98	16.3

Table 12. TRAP-ROCK QUARRY CRUSHING COSTS

Crushing Method			Loading Method H = Hand S = Shovel	Average Daily Stone Production, (Tons)	Range in Size of Dipper Capacity, (Cu. Yd.)	Range in Car Capacity, (Tons) (1 cu. yd. = 1½ tons)	Crushing Cost			Average Operating Cost per Ton Stone	Per Cent of Operating Cost for Crushing	Average Total Cost per Ton Stone	Per Cent of Total Cost for Crushing
Primary		Secondary Type					Primary	Secondary	Total				
Type	Size (1)												
Jaw	S	None	H	100	.....	.....	.....	.....	$0.35	$0.91	38	$1.34	26
Jaw	S	Gyratory	H & S	344	7–8	1.5–6	.....	.....	.44	1.09	40	1.59	28
Jaw	S	Jaw	S	820	3–4	2–3	$0.13	$0.04	.17	.67	25	1.28	13
Jaw	L	Gyratory	S	1262	1.25–6	3–10	.08	.05	.13	.59	22	.90	14
Gyratory	S	None	H	50	.....	1	.....	.....	.24	.87	28	1.13	21
Gyratory	S	Gyratory	H	700	.....	3	.....	.....	.15	.80	19	1.06	14

(1) S indicates primary crusher with receiving opening 24 in. square and less.
L indicates primary crusher with receiving opening over 24 in. square.

ployed a combination of gyratory, roll, and disk crushers.

Going to the larger producers of over 1,000 tons daily capacity, again 75 per cent prefer jaw crushers for initial reduction, but in this group there were no jaw-type machines listed as secondary breakers. All used gyratories for this step, or gyratories in combination with other types in which the disk predominated, although the cone type had its adherents.

It is interesting to note that where jaw crushers of less than 24-in. square opening were used as initial breakers, the crushed product after breaking averaged 4½ in. in size as reduced from quarry-run material. With the larger size of jaw crushers the first reduction averaged 7.2 in. The small gyratories averaged 5-in. stone and the larger size 6-in. stone after initial break.

Carrying this further, the average size of material fed to secondary crushers of the jaw type was 6½ in., while the feed to a combination of jaw and other types was 3 in. The feed to secondary gyratories was 5.8 in., and to this type in combination with others was 8½ in. The average setting of secondary crushers was for 2-in. material.

The fact is interesting that crusher sizes range from an 8-in. by 10-in. to a 66-in. by 86-in. jaw crusher and from a 10-in. to a 30-in. gyratory. Seventy per cent of the plants use electric power for crusher drives.

Table 12 shows such additional details of crushing costs as is possible from the replies.

In several of the tables where cost items, as presented in the columns, would be expected to add horizontally to totals on the right and do not, the explanation is found in that for different columns various numbers of quarries are averaged. As an example, in Table 3 it will be found that the various items which go to make up the total operating cost in the last column will not add to that figure. This is because not all reports contained costs in the same detail. Therefore the details involve different plants within that particular group.

Where spaces are unfilled there has not been sufficient data present to tabulate without fear of exposure of individual figures, or the few results have been so divergent as to be of little value.

The figures presented in Tables 1-12 represent data from a total of 27 quarries with an annual capacity of over 4,300,000 tons, or roughly one-third of the trap rock produced in the United States in 1927 for other than dimension stone purposes.

Sandstone

Sandstone as covered in this report is defined as that stone designated "sandstone" by the operators reporting. Several operators engaged in the production of ganister for silica brick interpreted the questionnaire as not applying to them since they did not sell their product as crushed stone. Several replies were so obviously the result of a misunderstanding of the information desired that they could not be used in compiling averages. Several operators reported quarry costs without giving crushing and overhead costs. (Table 13.)

Stripping

Only two quarries reported having any stripping cost. Of these, one stripped by hand with dump wagons and the other with a small shovel using auto trucks for transportation.

The first quarry, stripping by hand, hauled the dirt 200 feet to the dump at a cost of $1.48 per cu.yd. of waste, or 5 cents per ton of stone. The cost per 100 ft. of haul was 74 cents per cu.yd.

The second quarry, handling its dirt by shovel and truck, hauled 500 ft. at a cost of 98 cents per cu.yd., or 2.4 cents per ton of stone, with a cost per 100 ft. of haul of 20 cents per cu.yd.

The overburden in both cases was clay.

Table 13. SANDSTONE QUARRY COSTS

Loading Method	Number of Quarries	Average Wage Per Man-hour	Average Total Labor Cost Per Ton	Average Quarry Cost Per Ton	Average Crushing and Screening Cost Per Ton	Average Total Operating Cost Per Ton	Average Total Overhead Cost Per Ton	Average Total Cost Per Ton
Hand loading	4	$0.48	$0.85	$0.88	$0.19	$1.07	$0.28	$1.35
Shovel loading	2	.33	.30	.64	.12	.76	.70	1.46
Hand loading	7	.47	.83	.91	.....	.....	.....	.....
Shovel loading	4	.42	.30	.80	.....	.....	.....	.....

Drilling

Three quarries reported drilling costs. Two using hammer drills reported costs per foot of hole at 40 cents and 42 cents, and one using churn drills with a 7-in. hole reported $3 per foot.

One of the first two quarries did not report the drilling cost per ton of stone nor did it give data by which the cost could be computed. The other reported a cost of 14 cents per ton of stone. The quarry using the churn drills reported a cost of 6.4 cents per ton of stone, but calculations based on the spacing and depth of hole and height of quarry face together with the given cost of $3 per foot of hole show 15 tons broken per foot of hole, for which the calculated cost per ton for drilling would be 20 cents. In this calculation sandstone is assumed to weigh 150 lb. per cu.ft.

Blasting

Three quarries reported blasting costs. Two of these using hammer-drill holes averaged 8½ cents per ton for blasting, and the third, using 7-in. churn-drill holes, reported 7 cents as the cost per ton of stone.

Only one quarry reported loading costs separately; its costs amounted to 12 cents per ton for hand-loading. The same plant reported a hauling cost of 6 cents per ton, using hand-tramming to the foot of a gravity plane and hoisting by cable.

Another quarry loading by power shovel with a 3-cu.yd. dipper and hauling with 7½-ton trucks reported a combined loading and hauling cost of 18 cents.

Crushing

Four quarries segregated their crushing costs, which averaged 20 cents per ton.

All four plants use jaw-type crushers for initial breakers, three of small size and one large. One plant reported the use of gyratory and disk-type units for secondary crushing.

No data is available as to ratios of reduction.

Only one plant reported a secondary crushing cost, which was 4 cents per ton or 25 per cent of the total crushing cost.

The data above was taken from reports of 12 quarries, located in four states, which indicated an average annual production of 630,000 tons of sandstone or 14 per cent of the United States production in 1927.

Granite

The term "granite" as defined for this study includes other hard rocks such as syenite, quartzite, etc. As found in nature, some of these rocks are quite thoroughly shattered and cracked, although not broken from their original position. This shattered condition obviously has an important bearing on the cost of breaking, as less drilling and explosives are required. Comparisons made in Tables 14-16 will take this feature into account as far as possible.

The principal market for granite is as dimension or building stone, but quarries producing this type of granite were not solicited for costs.

Replies were received from seven granite quarries preparing crushed stone for market. Of these seven quarries, five gave cost details which are used in the tables. The other two were so out of line for various reasons that their inclusion would only tend to confuse the results. In presenting the tonnage produced per man-hour, all seven reports are used.

As may be expected with only a small number of reports from which data are available, many details are necessarily omitted in order to avoid publication of individual figures.

Table 14. GRANITE QUARRY PERCENTAGE COSTS

Tons Produced Daily	0—200		1,000—1,500		Over 2,000	
Method of Loading and Cost Details	Operating Cost	Total Cost	Operating Cost	Total Cost	Operating Cost	Total Cost
Hand loading: Number of quarries	2		..		..	
Wage cost	69	59	..	..	..	..
Quarry cost	79	68	..	..	..	..
Crushing and screening cost	21	18	..	..	..	..
Total operating cost	100	86	..	..	..	..
Overhead cost	..	14	..	..	..	..
Total cost	..	100	..	..	..	..
Shovel loading: Number of quarries	..		2		1	
Wage cost	..	..	39	32	53	34
Quarry cost	..	..	68	56	53	34
Crushing and screening cost	..	..	32	26	47	30
Total operating cost	..	..	100	82	100	64
Overhead cost	..	..	..	18	..	36
Total cost	..	..	..	100	..	100

Production

As a basis of comparison the tonnage produced per man-hour worked is often more informative than the costs per ton. With this in view Table 16 has been prepared in which information from all seven reporting quarries is tabulated.

The blank parts of the table represent either a lack of information or cases in which only one quarry is involved, so that publication would expose individual figures.

As may be expected the tonnage per man-hour is greater in quarries using shovels. This figure also increases as the daily production increases.

Table 15. GRANITE QUARRY COSTS

Loading Method and Daily Production	Number of Quarries	Average Wage Per Man-hour	Average Total Labor Cost Per Ton	Average Quarry Cost Per Ton	Average Crushing and Screening Cost Per Ton	Average Total Operating Cost Per Ton	Average Total Overhead Cost Per Ton	Average Total Cost Per Ton
0—200 tons: Hand-loading	2	$0.48	$0.90	$1.03	$0.28	$1.31	$0.21	$1.52
1,000—1,500 tons: Shovel-loading	2	.48	.33	.58	.27	.85	.19	1.04

Table 16. GRANITE QUARRY PRODUCTION

Daily Production	Loading Method *H = Hand S = Shovel*	Average Wage Per Man-hour (*Dollars*)	Days Worked Yearly	Average Height of Quarry Face (*Feet*)	Average Production in Tons Per Man-hour				Average Operating Cost from Table 15	Average Total Cost from Table 15
					In Quarry	In Crushing Plant	In Other Labor	In Total Labor		
0—200 tons:										
No. of quarries reporting		3	3	2	3	3	1	3	2	2
	H	$0.48	170	70	.55	3.4	6.2	.46	$1.31	$1.52
No. of quarries reporting		1	1							
	S	.56	215		.94			.94		
1,000—1,500 tons:										
No. of quarries reporting		2	2	2	2	2	2	2	2	2
	S	.48	178	150	4.41	15.5	8.2	2.35	.85	1.04
Over 2,000 tons:										
No. of quarries reporting		1	1	1	1	1	1	1	1	1
	S	.92	267	170	9.68	33.4	23.0	5.66		

Stripping

Only four quarries segregated their stripping costs. One quarry using auto trucks, gave $1 per cu.yd. as the total cost, but did not designate the method of excavating nor distance hauled. Several gave the distance hauled but no costs. One gave 50 cents per cu.yd. and 5 cents per ton of stone in removing 20 ft. of clay from 140 ft. of stone by contract, using scrapers, without notation of the length of haul. Another reported 1¼ cents per ton of stone for a 200-ft. haul in removing 5 ft. of clay from 160 ft. of stone, using a small power shovel and tramming by hand. This is the equivalent of 91 cents per cu.yd. or 45 cents per cu.yd. per 100 ft. of haul.

Another gave $.007 per ton of stone as the cost of removing 40 ft. of clay from 170 ft. of stone by hydraulic methods with a 5,000-ft. haul through flumes. This is the equivalent of $.066 per cu.yd. of overburden or $.0013 per cu.yd. per 100 ft. of haul. (This calculation is based on granite as weighing 168 pounds per cubic foot in place.)

Drilling

Four quarries segregated their drilling costs. One using hammer drills with 1½-in. holes 10 ft. deep reported a cost of 50 cents per ft. of hole drilled. One reported using the tunnel or coyote method of breaking but gave no segregated costs.

Two quarries using churn drills, cutting 6-in. holes to an average depth of 185-ft., averaged $1.55 per ft. of hole and 5½ cents per ton of stone, with secondary drilling costing 8 cents per ton, making the total drilling cost 13½ cents per ton of stone. Another quarry using the bench-and-toe method of shooting with piston drills, cutting 3-in. holes 22 ft. deep, reported a drilling cost of 2 cents per ton of stone produced. The stone in this latter quarry is not to be compared with the solid granites because of its fractured nature.

Blasting

One quarry that uses the coyote or tunnel method of shooting reports a blasting cost of 15 cents per ton. It is not clear whether or not this figure included the cost of driving the tunnels, but it probably does. Therefore the 15 cents should be drilling and blasting expense. The explosive reported was 40 per cent gelatin.

Three quarries using 6-in. churn-drill holes reported blasting costs averaging 7.7 cents per ton of stone, with 40 per cent and 60 per cent starch and nitroglycerin explosives.

The one quarry using the bench-and-toe method of drilling fractured stone with piston drills, reported a blasting cost of 2 cents per ton, using 20 per cent and 40 per cent starch explosives.

Loading and Transportation

Two quarries segregated their loading and transportation costs, and three gave these costs combined. One plant using both hand and power shovel loading reported 19 cents for hand, 11 cents for shovel, and 10 cents for transportation. The second with a larger production reported a shovel-loading cost of 5 cents and a transportation cost of 4 cents. Two plants loading and tramming by hand averaged 25 cents per ton, and one reported a total shovel-loading and transportation cost of 14 cents. The average shovel-loading and transportation cost of the three quarries was 15 cents per ton.

Type and size of shovels used in the above examples are not given in order to hide the identity of the quarries. For the same reason the daily production is not shown.

Crushing

Two quarries reported using small jaw crushers for both primary and secondary breaking, and five gave the gyratory type as their choice for both reduction steps. All used trommels for initial sizing, one supplemented them with vibrating screens for the finer sizes, and one used shaking screens. Five plants used electric power and two used steam.

Only one plant segregated crushing and screening costs in detail. At this plant with 16-in. gyratory electric-driven initial breakers followed by 12-in. gyratories for secondary crushing and trommel screens, the cost of first crushing from quarry-run size to 4 in. is given as 5.4 cents per ton, of secondary crushing as 6.7 cents, and of screening as 2 cents per ton.

Four plants employing gyratory units for all crushing averaged 9 cents for initial and secondary crushing. At these plants the initial break was a reduction from quarry-run size to an average of 4 in. in the first reduction, and from that to the usual commercial sizes in the secondary step.

Sand-and-Gravel Production in Arkansas Increased During Past Year

Four New Plants Built on Ouachita River in Southwest Part of State

By W. E. TRAUFFER

THE sand-and-gravel industry in Arkansas is affected to a greater extent, perhaps, than that of any other state by flood conditions. This is especially true in the southwestern part of the state, where most of the plants are dredging operations on the Arkansas and Ouachita Rivers and their tributaries. The streams in this section are noted for their sudden rises following a heavy rain and the short duration of the floods which seldom cause a shutdown of a plant for more than a few days. This is in contrast to floods in other sections which occur less frequently but are of much longer duration.

Most of the plants in this section are designed with the frequent floods taken into consideration so that outside of the delay in operations little damage is ever done except in extreme cases. The author recently had the experience of making a trip down the Ouachita River from Hot Springs to Camden, a distance of about 110 miles, while one of these floods was in progress. Four plants were visited, three of which went into operation last Fall, while one was just completed.

Phoenix Utility Co.

The first of the series of sand and gravel plants put into operation along the Ouachita River during the past year is that operated by the Phoenix Utility Co. for the Arkansas Power & Light Co. This was built to produce aggregate for the Carpenter hydro-electric project now under construction on the Ouachita River about four miles southeast of Hot Springs. This is the second of a series of three dams on the river which will develop 250,000 hp. hydro-electric energy when completed.

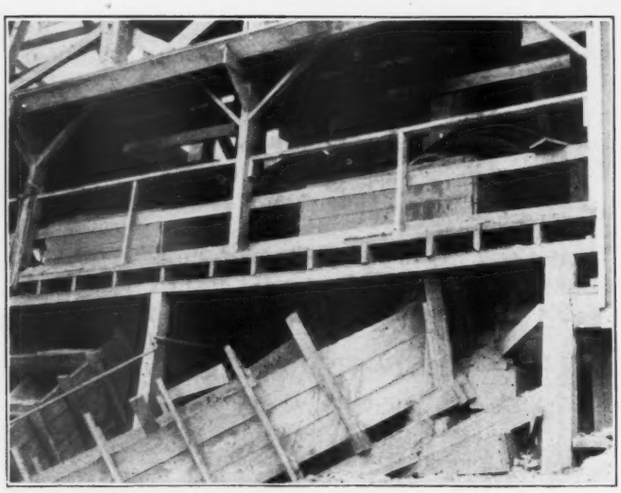
The Carpenter Dam is being built at a cost of about $8,000,000. It will be 1,164 ft. long and 105 ft. high and will form a lake with an area of 9,000 acres. It is being built of solid concrete, of which 200,000 cu. yd. will be required, using over 200,000

View of gravel storage from concrete plant. Derrick rehandling material. Note trestle for discharge to storage and tunnel conveyor for recovery.

bbl. of cement. Construction was begun in April, 1929, and full operation is expected by August 15, 1931.

All of the sand and gravel for this dam is furnished by a gravel plant having a capacity of 100 cu. yd. per hr., designed by the Smith Engineering Co. Gravel is being excavated from bars in the river 2½ miles above the dam by a P & H gasoline dragline with a 1½-cu. yd. Page bucket. This loads 2-cu. yd. Hug trucks which haul the material to the washing and screening plant and dump into a hopper.

A 30-in. by 5-ft. Telsmith plate feeder discharges onto a 30-in-belt conveyor on 181-ft. centers. This discharges through a 42-in. by 7-ft. rail grizzly at the top of the plant into a 48-in. by 20-ft. Telsmith heavy-duty washing screen with a 9-ft. sand jacket and cleaning rollers. Two sizes of gravel go directly to bins, while the sand goes to a No. 8 Telsmith sand settling tank. The oversize from the grizzly goes to a surge bin feeding a small jaw crusher and by belt conveyor back to the main conveyor. The three bins have a total capacity of 200 cu. yd.



The two 2-cu. yd. concrete mixers, one discharging to chutes.

The bins discharge through Telsmith bottom-discharge gates into 5-cu. yd. Western side dump cars, which are hauled a distance of 2½ miles to the plant by a 20-ton steam locomotive. Here the cars are hauled two at a time up an incline onto a trestle by a cable hoist and dumped into a 3-compartment open end bin storage with a capacity of about 17,000 cu. yd.

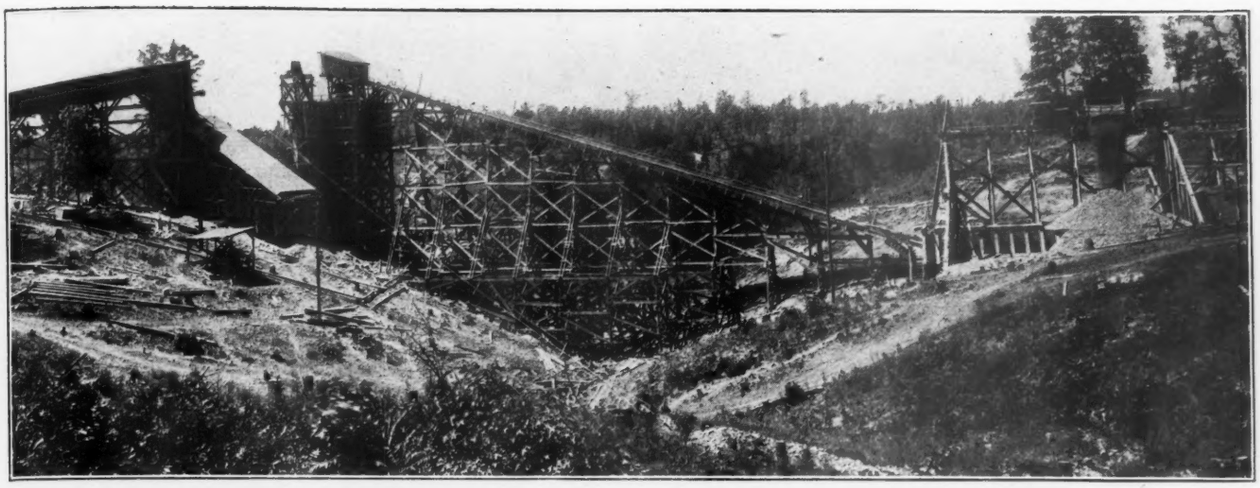
The material is recovered from storage, through Telsmith Boquad gates, by a 24-in. belt conveyor in a timber tunnel under the storage piles. This runs horizontally under the piles and is then inclined to the top of the concrete mixing plant, operating on 349-ft. centers. Excess storage is handled by a stiff-leg derrick with a Haiss clamshell bucket.

The conveyor discharges through a turntable chute into any of 3 bins at the mixing plant with a total capacity of 180 cu. yd. The bins discharge through Blaw-Knox air-operated gates into a weighing batcher equipped with a Fairbanks dial scale. This discharges through a split chute into two T. L. Smith Type 563 2-cu. yd. tilting mixers. The 3-minute mix enables the single batcher to serve both mixers without delaying operations.

Conveyor from storage to concrete mixing plant of Phoenix Utility Co.

Bulk cement is received in box cars and unloaded

The up-river side of the new Carpenter Dam. Two whirleys at right handle concrete from cars into place.



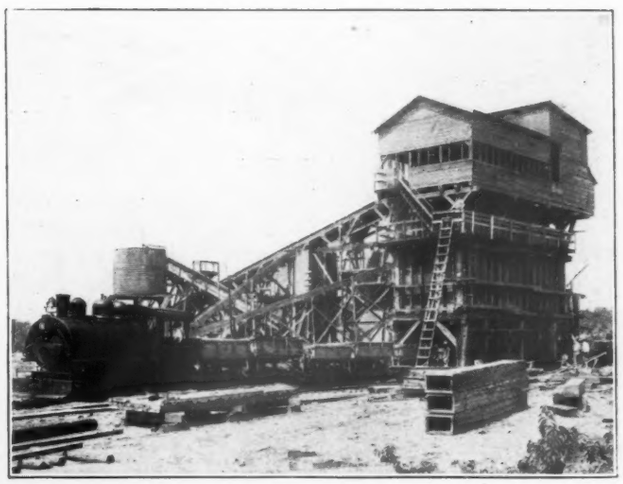
Concrete mixing plant for Carpenter Dam at left. Material storage and recovery tunnel at right.

by a Stephens-Adamson box-car unloader onto an inclosed belt conveyor. This discharges through a chute into a sloping wooden silo from which a screw conveyor and bucket elevator feed to a 220-bbl. capacity bin above the mixers. This discharges to a separate weighing hopper, also equipped with a dial scale. Water is measured in a float-valve tank with a water glass to check measurements.

Truck discharging material from pit to hopper at plant of Phoenix Utility Co.

This plant produces 80 cu. yd. of concrete per hour.

The concrete mixers discharge through chutes 70 ft. long on a slope of about 27 deg. to a hopper. This discharges into 2-cu. yd. dump buckets mounted two on a flat car. These are hauled to the dam, where two 8-ton capacity Wiley self-propelled



The washing and screening plant of the Phoenix Utility Co.

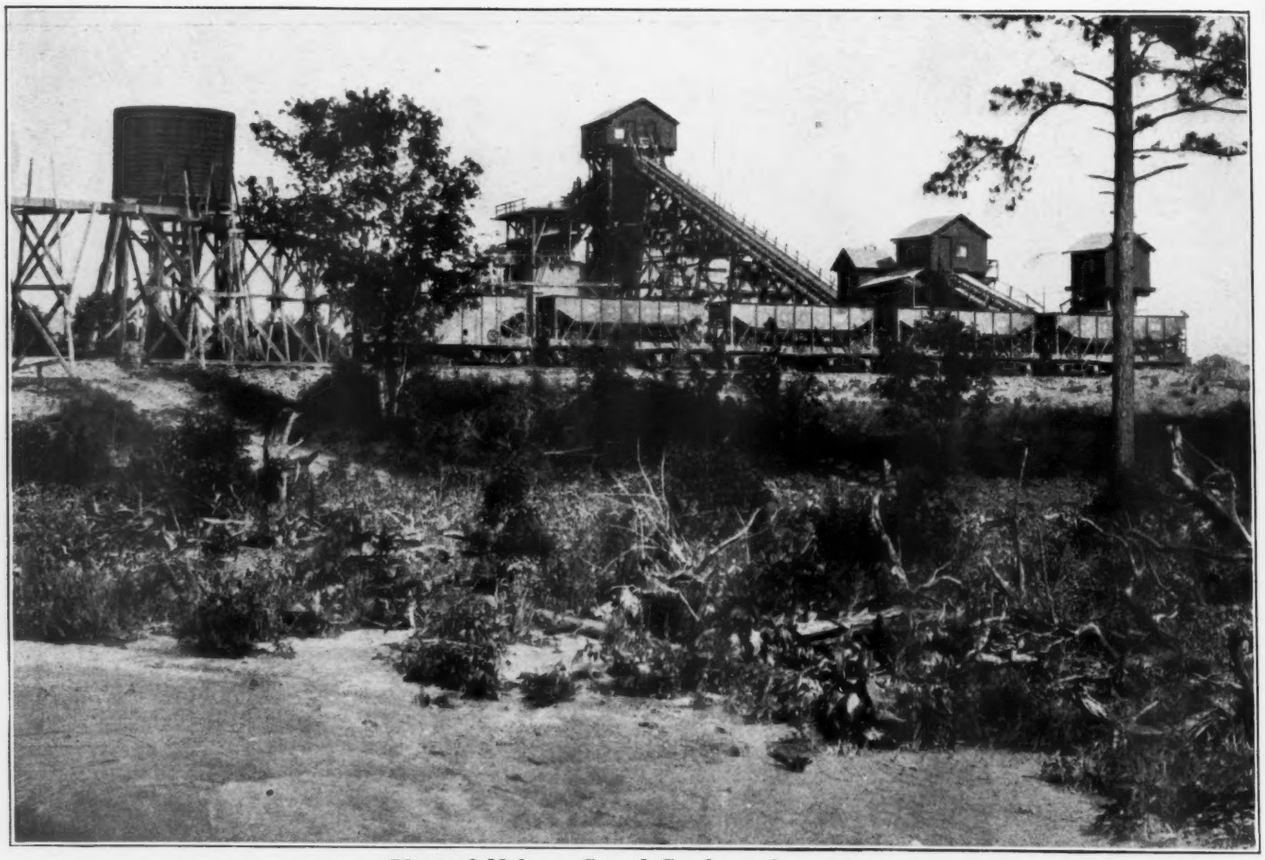
electric whirleys discharge the concrete wherever desired.

Most of the equipment for these plants was furnished by the Smith Engineering Co., including belt conveyors, gates, screens, screw conveyors, elevators, etc. Goodyear conveyor belting, General Electric motors and Crosby cable clamps are used. All buildings are protected by Pyrene fire extinguishers.

The floods which caused so much damage along the river also shut down operations here for some time. The river at this point rose to 22 ft. above its normal level, rising 12 ft. in 4 hours. Day and night work was necessary to keep the dam clear of drift, however, until the crest of the flood had passed.

Malvern Gravel Co.

The next plant called on was that of the Malvern

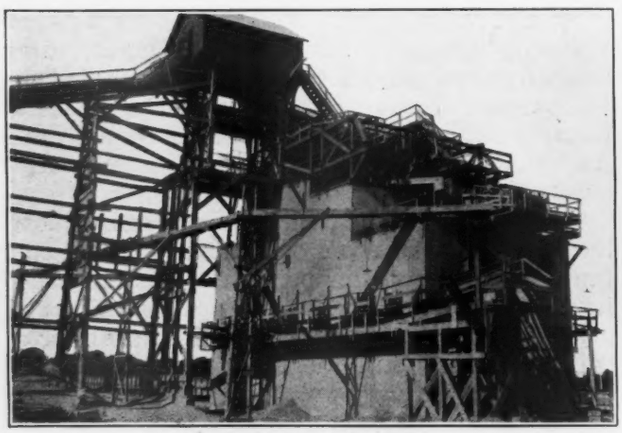


Plant of Malvern Gravel Co. from the west.

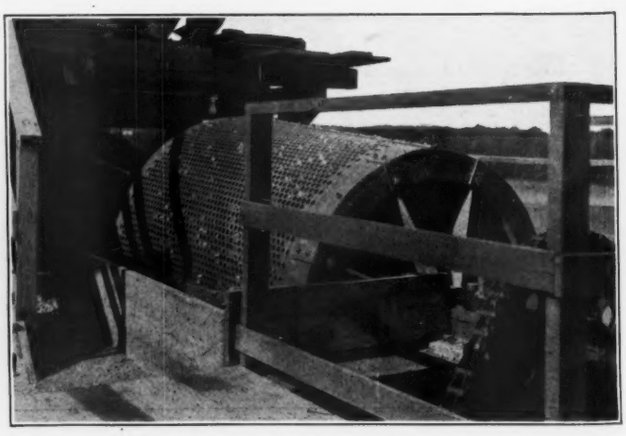
Gravel Co. at Malvern, Ark. This is on the Ouachita River about 20 miles southeast of Hot Springs and 45 miles south of Little Rock. It is a dragline operation working gravel beds several hundred acres in extent along the banks of the river. The plant, which has a capacity of 100 cars of washed ballast, or 65 cars of washed and graded gravel and sand in an 8-hr. day, went into operation on Sept. 12, 1929.

The deposits average about 30 ft. in depth with an 8 to 10-ft. overburden and contain about 30 per cent sand with about the same percentage of gravel over 2 in. in size. Excavating is done by two Monighan steam draglines with 60-ft. booms handling 2-cu. yd. Page buckets and a Northwest gasoline dragline with a 50-ft. boom handling a 1-cu. yd. Page bucket. Another Monighan steam dragline which is now being installed has a 100-ft. boom and a 4-cu. yd. Page bucket. Material is conveyed to the plant in 30-cu. yd. capacity standard gauge steel bottom-dump cars. These are hauled to the plant by three oil-burning steam lecomotives: a Davenport 48-ton; an American 52-ton; and a Baldwin 62-ton 6-wheel switch-type locomotive.

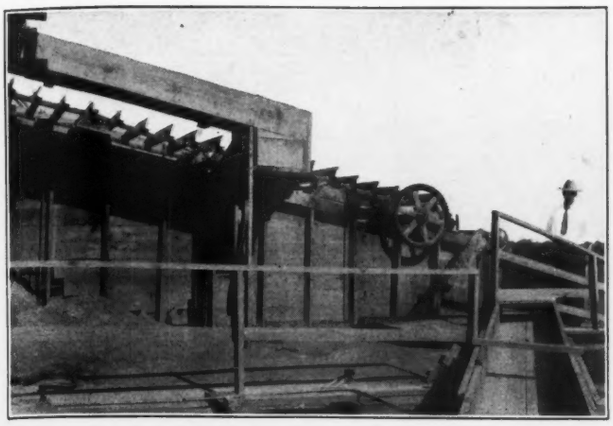
The cars dump into a steel track hopper at the plant, from which the material is fed by a Stephens-Adamson 60-in. by 42-in. pan conveyor onto a 30-in. inclined belt conveyor on 130-ft. cencenters to the scalper building. Here it is discharged into a Stephens-Adamson 48-in. by 10-ft.



Close-up of washing and screening building.



One of the sizing screens.

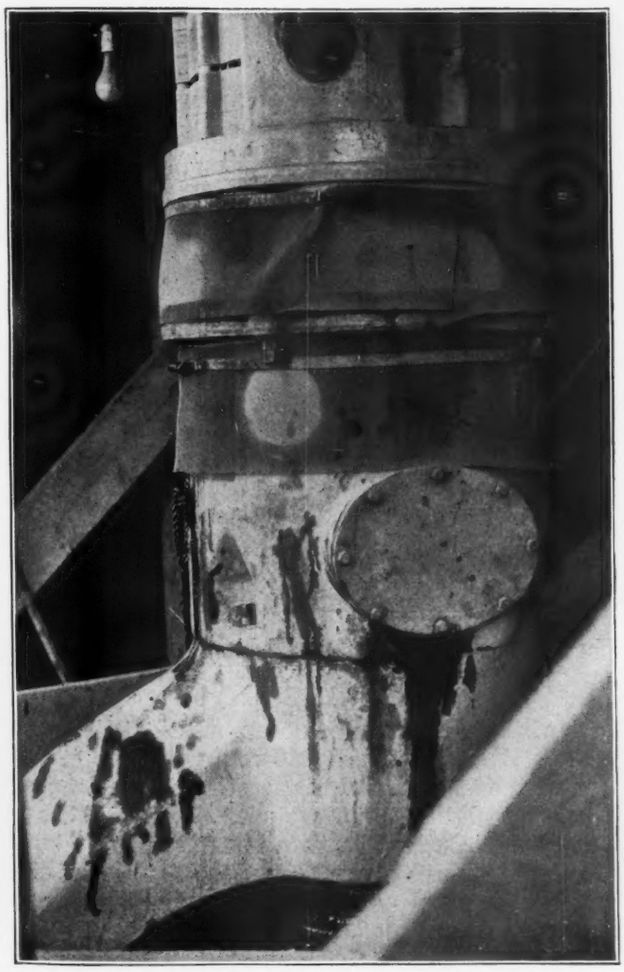


Close-up of one of the sand drag boxes at the Malvern Gravel Co.

revolving scalping screen with 2½-in. perforations. The oversize can be chuted to a No. 10 Allis-Chalmers Newhouse crusher or an Austin No. 5 gyratory crusher so arranged that either or both can be used as desired.

The material from the crushers and that passing through the scalping screen discharges to a 30-in. inclined conveyor on 227-ft. centers. This conveyor discharges into a split chute with a flop gate which feeds to one side of the plant when ballast is desired and to the other side for graded gravel. A 48-in. by 10-ft. rotary scrubber was installed when the plant was built, but there has been no need for it as yet.

F. Glenn, superintendent, and Frank McGillicuddy, right, general manager Malvern Gravel Co.



Direct-connected crusher at the Malvern Gravel Co. plant.

The ballast plant consists of two No. 3 84-in. Stephens-Adamson Gilbert screens with 1½-in. perforated inner jackets and ¾-in. outer jackets. The fine material goes to a Stephens-Adamson 60-in. by 20-ft. drag classifier. Chutes from the screens and classifier are so arranged that the material is delivered to the bins in the proper propor-

One of draglines loading to cars. F. McGillicuddy at left, H. F. Riley, second from right.

Supt. C. E. Hawkins of the Arkadelphia Sand & Gravel Co., and the skip hoist.

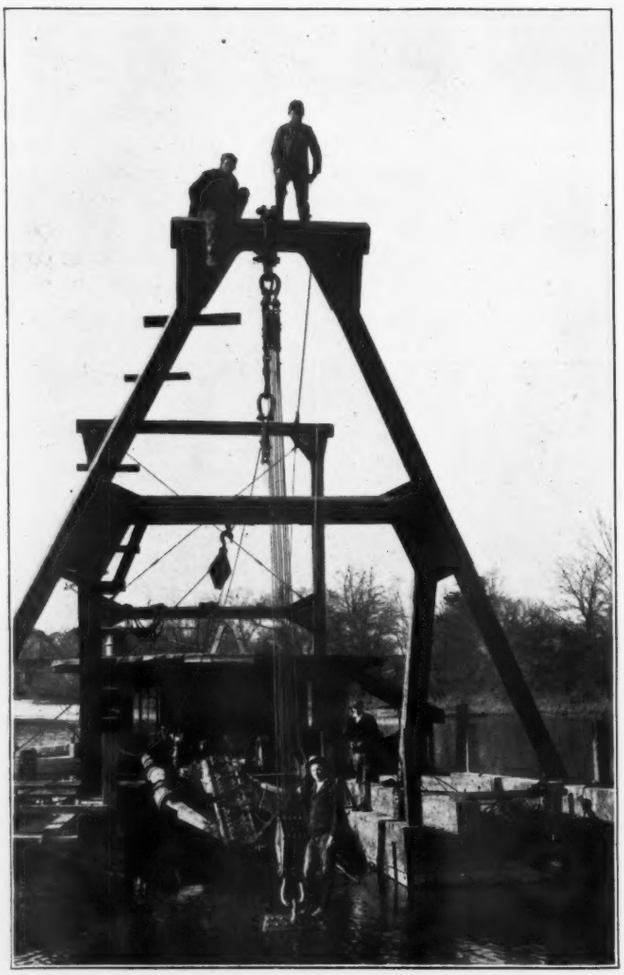
tions for ballast.

The commercial product is screened through two No. 3 Gilbert screens with 1½-in. outer and ¾-in. inner jackets and two No. 1 screens with ¼-in. perforations. The fines go to another 60-in. by 20-ft. drag classifier. The washed product is chuted to bins. The bin structure supporting the plant is of concrete and has seven compartments with a total capacity of 30 cars. Two bins are for ballast, one for sand, and the other four for the four sizes of gravel.

The bins have seven gates on each side. On the east side drop-chute gates load direct to cars. On the west side, however, only the two ballast bins discharge directly to cars. The other five gates in the commercial bins discharge through quadrant gates onto a horizontal belt conveyor, allowing any mixture desired to be produced. These gates are all calibrated and allow proportioning of the material to any specification with an accuracy of within 2 per cent in either direction. Two Thomas 1-drum, 7½-hp. electric hoists, one on each side of the plant, spot the cars for loading.

The waste sand and water is flumed to a near-by pit. A stationary screen with baffles about halfway down the flume separates out about 2 cars of engine sand per week into cars on a track below. This is rewashed on a perforated chute to the car. In this way a product with less than 1 per cent of silt is produced at slight expense. Wash water is furnished by two Allis-Chalmers Type S 1200-g.p.m. centrifugal pumps on the river bank near the plant.

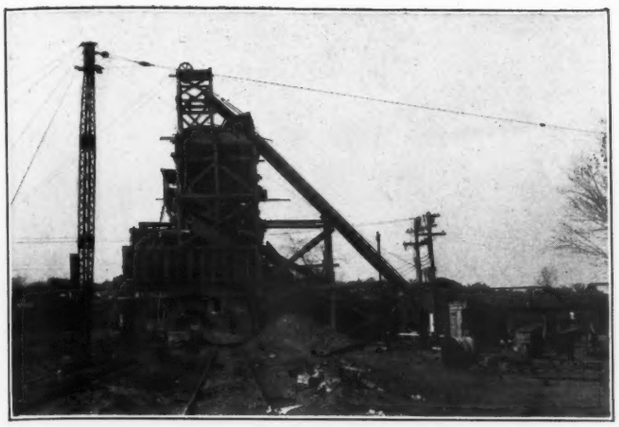
All screens, conveyors, feeders, classifiers, gates and chutes were furnished by the Stephens-Adamson Mfg. Co., and U. S. Rubber Co. conveyor belting is used. The conveyor to the scalping screen is gear-driven by a 35-hp. General Electric motor and drives the feeder from its tail pulley. The scalping screen is belt-driven by a 7½-hp. Allis-Chalmers motor and the main conveyor is driven by a 50-hp. motor of the same make through a Texrope drive. Each pair of sizing screens is chain-driven by a 10-hp. Allis-Chalmers motor, and each of the classifiers by a 5-hp. motor of the same make. All motors are 220-volt with the exception of the 100-hp. motor operating the Newhouse crusher and the pump motors, all of which are 2,300 volt. Cutler-Hammer controllers and starters, Square D safety switches, General Electric circuit breakers and magnetic switches, and Shearard-uct conduit are used.



The dredge used by the Arkadelphia Sand & Gravel Co., showing the screen nozzle ladder.

The single-deck vibrating screen at the Arkadelphia plant.

Most of the product is ballast which is used by the Missouri Pacific Ry. The sized gravel is used



Skip car dumping at top of plant. Auxiliary slackline cableway at left.

mostly for state and county roads and city streets within a radius of 50 miles. Ballast is shipped considerably further. The plant has track storage for 146 cars and is connected with the M. P. and the C., R. I. & P. Railways by the 2½-mile Malvern & Ouachita River Ry., which is operated by the company.

The office, storeroom, machine shops and other miscellaneous buildings are all located near the plant. F. Glenn is plant superintendent. The company has no officers, but is owned by four partners: Frank McGillicuddy; H. F. Riley and E. M. Hall of Chicago; and J. J. Ball of Little Rock. Mr. McGillicuddy acts as manager and resides in Malvern. Mr. Hall and Mr. Riley are members of the firm of Clapp, Riley and Hall, which furnished a large part of the equipment for the plant. Mr. Ball formerly operated the Ball-Benton plant at Benton, Ark.

The property on which the plant is located was for hundreds of years the site of a large camp of the Ouachita Indians. Many relics have been dug up here, and every rain uncovers innumerable flint arrow and spear heads. Many graves have also been uncovered. The company has an unusually good collection of these relics, including pottery, and axe, arrow and spear heads.

The floods did no great damage here, as the water did not reach the plant. The pits, however, were inundated and ½ mile of the 1-mile track to the plant was partly washed out. One of the draglines which was operating near the river 10 ft. above normal level was entirely submerged and had to be overhauled. Operations were delayed about a week. This was the fifth flood since the plant went into operation.

Arkadelphia Sand & Gravel Co.

Another new plant which went into operation on August 15, 1929, is that of the Arkadelphia Sand & Gravel Co. at Arkadelphia, Ark. This is a dredging operation on the Ouachita River and has a capacity of 35 cars of gravel in a 12-hr. day. Arkadelphia is about 28 miles southwest of Malvern.

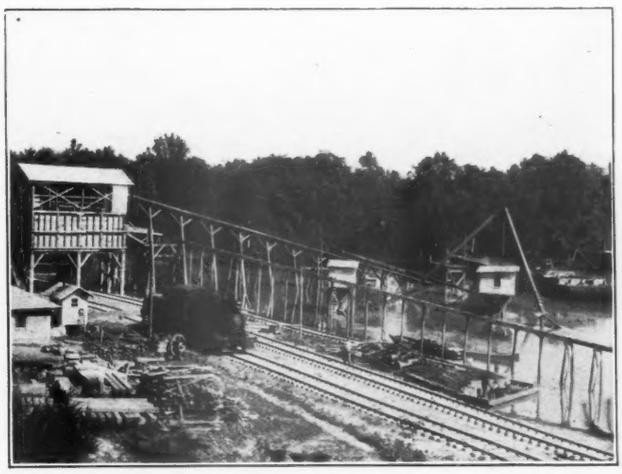
The wooden dredge hull is in four parts, which are hooked together. The main hull is 40 ft. long by 20 ft. wide and supports the 10-in. Amsco dredge pump and the Sterling 2-drum hoist which handles the intake nozzle and one of the shore lines. The pump is direct driven by a 250-hp. 2,300-volt electric motor and the hoist by a 15-hp. motor. Goodyear suction hose is used. A Worthington vacuum pump primes the dredge pump.

The second hull is 16 ft. long by 32 ft. wide and is fastened crosswise at the end of the main hull. This supports the 40-ft. Eagle Swintek screen nozzle ladder, which is driven by a 20-hp. General Electric motor through a Chicago Belting Co. Sea Lion leather belt. The two small pontoons are each 25 ft. long by 10 ft. wide and are fastened to the second hull in such a way as to form a well for the ladder 12 ft. wide by 26 ft. long. These support the timber A-frame from which the ladder is suspended. One also carries a Novo 2-drum hoist which handles two shore lines. Power is delivered to the dredge at 2,300 volts through a General Electric lead-covered submarine cable. Transformers reduce to 220 volts for the small motors.

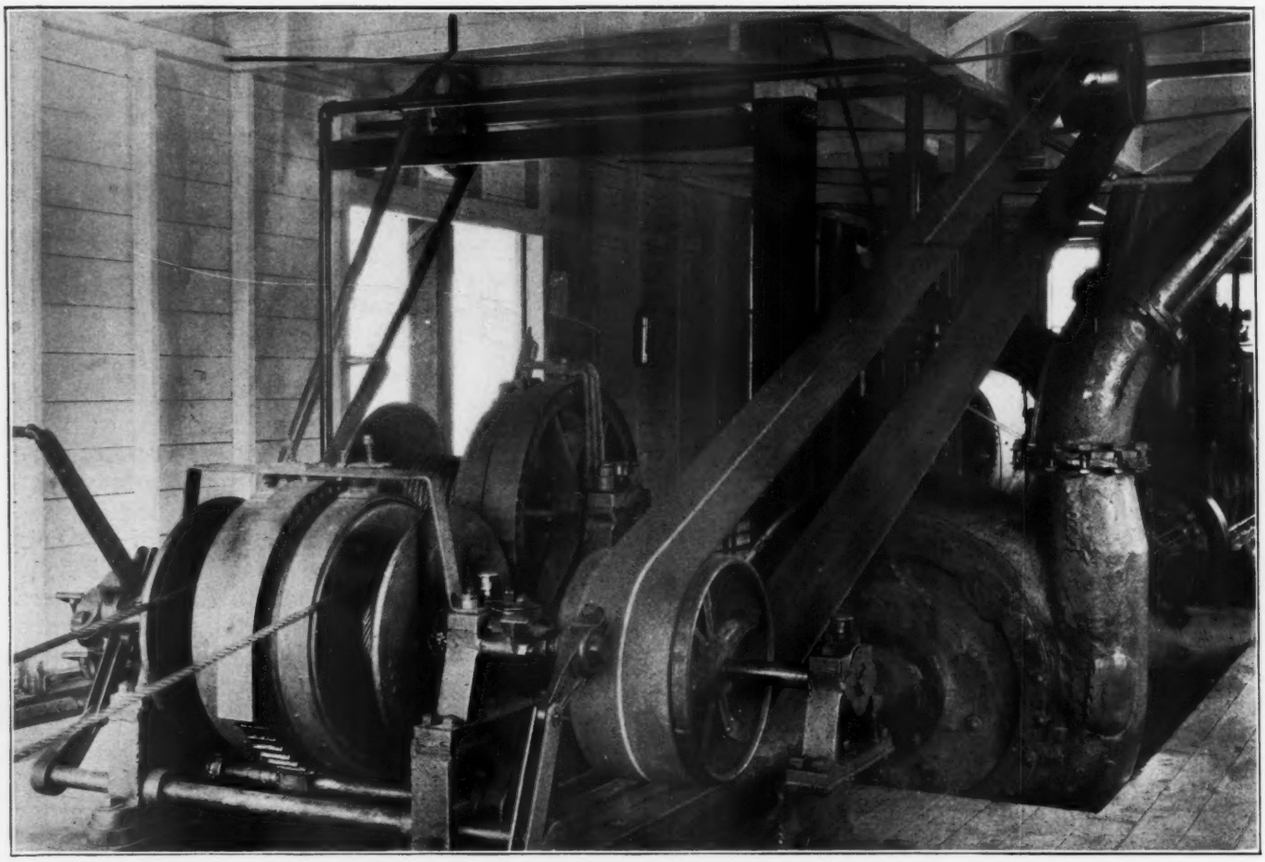
The dredge line discharges at the plant to a concrete hopper. This feeds through sliding gates to two 3-cu. yd. steel cars on a balanced type skid. A Greenville Mfg. Co. 5-ft. by 18-ft. revolving screen with a sand jacket produces two sizes of gravel and sand. The sand goes to a settling tank and to a bin. The gravel can when desired be run to a Hum-mer 4-ft. by 4-ft. single-deck vibrating screen for special sizes. The six bins have a total capacity of 18 cars and discharge through bottom gates to cars on two tracks underneath.

The hoist operating the skip is on the opposite side of the plant with the cables running over the top, subjecting the structure to only downward stress. The American Hoist & Derrick Co. 1-drum oppositely wound hoist is driven by a 60-hp. electric motor and has a General Electric automatic solenoid brake in addition to the regular brake.

There is little oversize produced, but this is crushed by a Webb City & Carterville 10-in by 14-in. jaw crusher and returned to the hopper by a short horizontal belt conveyor. Outside of the



Plant derrick and dredge of Standard Gravel Co. from south.



Interior of the new dredge of the Standard Gravel Co. Heavy-duty 10-in. dredge pump at right. Three-drum hoist at left. Diesel engine in background.

washing out of 100 ft. of track and a 10-day shutdown little damage was caused by the flood.

When the property was purchased it included an old plant which has since been dismantled. A 1-cu. yd. Sauerman cableway excavator from this plant was moved to the new plant and is used as an auxiliary. The bucket discharges to the same hopper as the dredge but over a rail grizzly. The plant was designed by F. M. Welch of the F. M. Welch Eng. Service, and the dredge by Bradley Carr of the American Manganese Steel Co.

Dredge of Standard Gravel Co. with settling box and chute above.

The main office of the company is at 722 Falls Bldg., Memphis, Tenn. C. C. Hawkins is president, and his son, C. E. Hawkins, is plant superintendent.

Standard Gravel Co., Inc.

The Standard Gravel Co., Camden, Ark., recently put into operation a new 150 t.p.h. capacity dredging and screening plant on the Ouachita River, which is one of the best equipped in the state. It was designed by J. W. Sanders, president of the company, and built under his supervision.

The dredge has a 10-in. heavy-duty Amsco pump driven by a 4-cyl. 140-hp. Fairbanks-Morse Diesel engine, which also operates other equipment on the dredge. Barges are hauled to the plant by a towboat, which is also driven by a Fairbanks-Morse Diesel engine.

The barges are unloaded at the dock by a stiff-leg derrick and clamshell bucket, which feeds a hopper and belt conveyor to the screening and washing plant. Sizing is done by a Telsmith heavy duty revolving screen and a sand settling tank of the same make. Graded gravel and sand and ballast are produced. This plant will be more completely described in a later issue of PIT AND QUARRY.

Gantt Gravel & Sand Co.

A fifth plant was called on which was not on the Ouachita River and was not subject to flood conditions. This was the operation of the Gantt Gravel

& Sand Co., about 7 mi. west of Magnolia, Ark. While a small plant with a capacity of 750 cu. yd. per day of gravel and 400 cu. yd. of sand, it is of interest because of several unusual features in the operation and management of the plant.

The 100-acre deposit is a good grade of gravel, most of which is used locally for roadwork, all shipments being made by truck. A P & H shovel loads the material into trucks, which haul it to the

General view of the Gantt Gravel & Sand Co. plant showing trucks discharging to hopper.

plant. Here they discharge into a hopper from which a belt feeder feeds an inclined belt conveyor to the plant. This discharges to three Stephens-Adamson Gilbert screens for sizing and a fourth which is used for rerinsing when necessary. Sand is separated in two sand boxes.

This plant, although only 3 years old, is driven by steam from a central power plant, each piece of equipment being driven by chain or belt from line shafts. C. J. Gantt, owner and operator, said that this form of power was the most economical in this particular plant because of the large amount of timber on the property which had to be cleared away before the gravel could be excavated and would otherwise go to waste.

Mr. Gantt has an original system of handling his expenditures which eliminates all bookkeeping. All expenses are paid immediately in cash, whether they be wages, new machinery or any other expense. The drivers who haul from pit to plant are paid after each load is delivered, thus eliminating any possibility of error, while other employees are paid at the end of each working day. According to Mr. Gantt, this method also results in better-satisfied labor.

He also attempts to sell his product for cash whenever possible, and has had unusually good results and few bad accounts by giving large enough discounts to make cash payments attractive to his customers. Accounts paid within 15 days are discounted 5 per cent, while those paid within 30 days are discounted 2 per cent.

Mr. Gantt is planning to erect a new sand and gravel plant nearby to be in operation within a few months. This plant will be operated in a similar manner to the present plant except that it will probably be electrically operated. A capacity of at least 1,500 cu. yd. per day is planned. A concrete tile plant will also be erected in Magnolia which will use the excess sand from both plants.

Committee on Airport Drainage and Surfacing Organized

The technical resources of the American Engineering Council, the American Road Builders' Association and the Aeronautics Branch of the Department of Commerce, insofar as they relate to airport engineering and construction, have joined into one group to undertake the solution of the problems involved in one of the most urgent needs of airport development and air transportation—adequate drainage and surfacing for airports.

The absence of uniform and thorough applications of adequate drainage and surfacing for airports has been responsible for accidents to planes in landing and taking off from airports and landing fields; for delays and interruptions in departures and arrivals of aircraft and has involved the wastage of thousands of dollars in time and money in connection with airport or landing-field projects.

The three organizations have designated representatives to serve on a committee organized by Clarence M. Young, Assistant Secretary of Commerce for Aeronautics, and known as the "Committee on Airport Drainage and Surfacing," which will undertake, at once, a comprehensive and thorough study of the problems involved; collect and correlate available information and experience and present its findings and recommendations in a report that will serve as a working tool in the hands of engineers engaged in the development of air terminals, and also will meet the constantly increasing demand for information on this subject. The committee is under the chairmanship of Harry H. Blee, Director of Aeronautic Development, Department of Commerce.

Domestic Graphite Sales in 1929 Show Considerable Improvement

The total quantity and value of graphite sold by graphite miners in the United States in 1929 were considerably larger than the corresponding figures for 1928, according to the United States Bureau of Mines. The sales of natural graphite by producers in 1929 were 6,458 tons, valued at $310,891, an increase of 847 tons, or 15 per cent in quantity, and $13,798, or 5 per cent in value. The increase in quantity of sales was chiefly in the amorphous variety. The total sales include 3,555 tons of amorphous and 2,903 tons of crystalline graphite. This was an increase of 561 tons, or 19 per cent, in the former and 286 tons (573,110 lb.), or 11 per cent, in the latter. The value of the amorphous variety increased $3,330, or 8 per cent, and the crystalline variety increased $10,468, or 4 per cent.

Safe Practice Rules to be Observed in the Waste-Heat Boiler Room*

By C. M. CARMAN
Superintendent, Independence, Kan., plant, Universal-Atlas Cement Co.

IN NO department of a cement plant does proper design play such an important part in determining the general safety of the department as is the case in the boiler-room. This is especially true in a waste-heat plant.

We are not concerned here with safe design of boilers. As all reputable boiler-makers build their boilers to conform to certain established safe codes we can pass over that part. We, as operators, are responsible in that it is up to us to install, so equip, and so operate a boiler plant that there will be little chance of an accident. We, therefore, must keep before us the fact that high-pressure steam is potentially dangerous, and we must handle it with care. As the design of a boiler-room is such a vital factor in making it a safe department, I will touch briefly on a few of the essentials that must be considered.

We must first select a boiler suitable for our particular needs. We must then erect it in a safe manner so as not to damage it before it is in operation. It should be bricked up in such a manner that both the boiler and the brick setting be free to move independently under heat stresses.

We must see that all of the fittings are of suitable material for the service required. The use of steel fittings is recommended. Flanges should not be screwed onto the pipe but should be attached by some sort of rolled joint. Proper gaskets should be used. Long-radius pipe-bends must be used to avoid undue expansion stresses. These are especially important near outlets of boilers and where pipe is attached to steam-using equipment. Automatic non-return valves should be used if more than a single boiler is connected to a header.

Waste-heat boilers make use of their safety valves more frequently and for longer periods of time than do fuel-burning boilers. The rate of feeding fuel in the ordinary boiler is under the control of the boiler operator in the case of fuel-burning boilers. This is not the case in a waste-heat system as the burners in the kiln room control this. Thus a waste-heat plant takes whatever heat is available and uses it in making steam, regardless of whether the steam is needed or not. As a result there are often times when excess steam is produced and must be gotten rid of through the safety valves. Hence, I have found it good practice to pay more attention to the condition of safety valves on a waste-heat boiler than would be necessary with an ordinary boiler. We inspect these valves frequently and look them over internally whenever a boiler is out of service.

It is important that escape pipes be provided for the discharge side of the safety valves, but these should lead up through the roof and never be installed in a horizontal manner.

Gauge glasses should be clearly visible and properly lighted by a shaded electric light.

If economizers are used they should be protected from pump pulsation strains where reciprocating boiler-feed pumps are used. This can be done by means of a relief valve with an air chamber.

We have had trouble with broken headers on economizers. These are cast iron. We have protected the operators by covering these headers with heavy steel shields so that in case of a ruptured header no one will be scalded.

There is usually very little moving machinery to be guarded in a boiler room. But such as there is should be protected.

I have found that dust causes most of the hazards in a waste-heat plant. This is dust carried out of the kilns with the waste gases. This dust settles in the flues between the kilns and the waste-heat boilers, builds up in the boilers, and must be constantly cleaned out. It cuts out the boiler tubes and wears out the blades of the draft fans. In removing this dust we use lances and compressed air. We originally used lances and high-pressure steam. This was discontinued because it was unsafe. Since the dust is so abrasive and cuts out the boiler tubes in the last pass we have to watch these tubes carefully. Normally we wash our boilers at intervals of four months. At such times we carefully examine the tubes in the group subject to wear.

The blades of the draft fans pulling the gases through the kilns and boilers wear out about every four to six months. By making frequent inspections we keep informed as to the condition of each fan. If a fan runs in an unbalanced condition due to wear it is immediately inspected and repaired.

The dust drawn from the hot flue between the kilns and boilers and from the boiler settings must be carefully handled. This is because this dust ranges in temperature from 1500 deg. F. to 350 deg. F. depending upon which part of the system it covers. We have made every effort to keep this dust inside of a spout or inside of a conveyor box. It runs like water and, when using the compressed-air lances, care must be taken that nothing is blown out where it can injure anyone. We have all of our dust-blowers wear goggles and so far have had no lost-time accidents from dust burns.

We handle the recovered dust in a screw conveyor designed to handle the high temperatures, to keep the dust in the box, and the men out.

* Paper read March 25, 1930, at Portland Cement Assn. regional meeting, Kansas City, Mo.

Survey Indicates Improvement in Building Industry Before End of Year

Highway Construction Aids Unemployment Conditions in Many Areas Over Country

CONFIDENCE that the next six months will bring definite improvement to the construction industry is shown in the mid-year survey by the Universal Atlas Cement Co., a subsidiary of the United States Steel Corp., in which responses were received from 163 sales and technical representatives in 42 states.

Of the company's representatives, 124 answered "better" or "no change" to the question, "What are construction prospects for the rest of the year?" and only 39 answered "worse." "Better" led "worse" 3 to 1 in the East, and 4 to 1 in the South and the two were nearly even in the Great Lakes region.

"We felt that reliable information on construction would come from these field representatives," said B. F. Affleck, president, in commenting on the survey, "because they are in constant touch with architects, engineers, contractors, dealers, public officials and others who shape and execute construction programs."

B. F. Affleck.

In the highway construction field, 88 representatives found the work ahead of last year, 38 found it equaling last year and only 31 reported evidence of decline. The biggest gains were reported in the East and the farm belt, with the smallest in the South. Street-and-alley paving was generally said to be under last year. In the public buildings field a substantial majority stated work was as great as or greater than 1929. No immediate improvement in the residential field was anticipated.

An employment-situation question drew 35 replies of "getting better," 53 of "getting worse" and 72 of "no change." The public was planning to take vacations as usual, 88 reported, while 71 reported vacation plans somewhat curtailed.

Little sentiment is shown either for or against the new tariff law, according to this survey. Districts "pleased" by the tariff led those "resentful" by a score of 28 to 18. Even in the South the sentiment was about equally divided; but the survey's highest total, 108, went to the great American attitude, "indifferent."

Road Building Aids Workmen

Because there is urgent need for more smooth pavements, and because pavement construction provides a considerable volume of work, communities throughout the country are discovering that accelerated highway programs are greatly relieving unemployment, according to the Portland Cement Association.

Representative of what a pavement program can do for a state is the present situation in Iowa, a state with a penchant for determining the whys and wherefores of its road expenditures. Thirty thousand workmen on Iowa roads are engaged this year in earning for themselves no less than $18,000,000. This means that more than half of the $33,000,000 Iowa is spending in 1930 on roads will go directly into the pockets of workmen. Further, all this road money will represent backed-up purchasing power that will stimulate business and industries not even remotely connected with highways.

Incidentally, Iowa's roads were nine-tenths mud in 1920; at the end of 1930 they will be 80 per cent surfaced through the wise use of bond-issue funds. Iowa is keeping its money in circulation.

Superior, Wis., has, like many other cities, been engrossed in solving the unemployment problem. And Superior, similar to countless other cities, has a real need for additional smooth, hard-surfaced streets. Accordingly, advantage is being taken of the present low prices of pavement construction, with 50 blocks of concrete pavements doubtless to be installed before the year is ended. This construction program is not only providing considerable employment, but the example is inducing private business to broaden its activities and employment.

Stimulation of construction by governmental units might seem at first glance an artificial means of bringing back natural prosperity. However, in regarding public construction on the basis of need alone it becomes obvious that the requirement for public structures is not imaginary. For example, no community as yet can say that it has enough, or almost enough, well-paved highways. Consequently, those communities that are doing nothing to speed up the building of needed improvements are contributing to a continued lull in business.

Transportation of Raw Material From an Underground Limestone Mine*

By RALPH W. SMITH
Mine Superintendent and Director of Research Peerless White Lime Co., Ste. Genevieve, Mo.

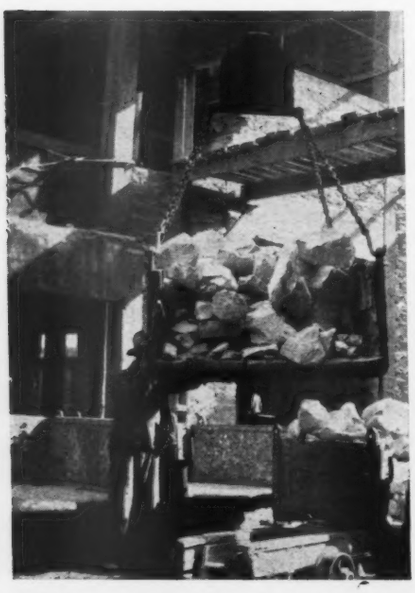
A SUBSTANTIAL part of production costs in mining operations is usually represented by items which can be grouped under a general heading of "Transportation," even though some difference of opinion may prevail as to where the dividing line between "Transportation" and "Refining" or "Treatment" is drawn, because the labor involved is under two different departments of supervision. An interesting example of this is found in the handling of the raw product at the limestone mine of the Peerless White Lime Co., situated at Ste. Genevieve, Mo., which company is a subsidiary of the Hunkins Willis Lime & Cement Co. of St. Louis. Whatever the differences may seem to be between the transportation problems of metal mines and those of limestone mines, such differences are to a great extent superficial and are probably intensified by the narrow margin in the lime industry that results in conditions in which operators are frequently what are known as "marginal producers."

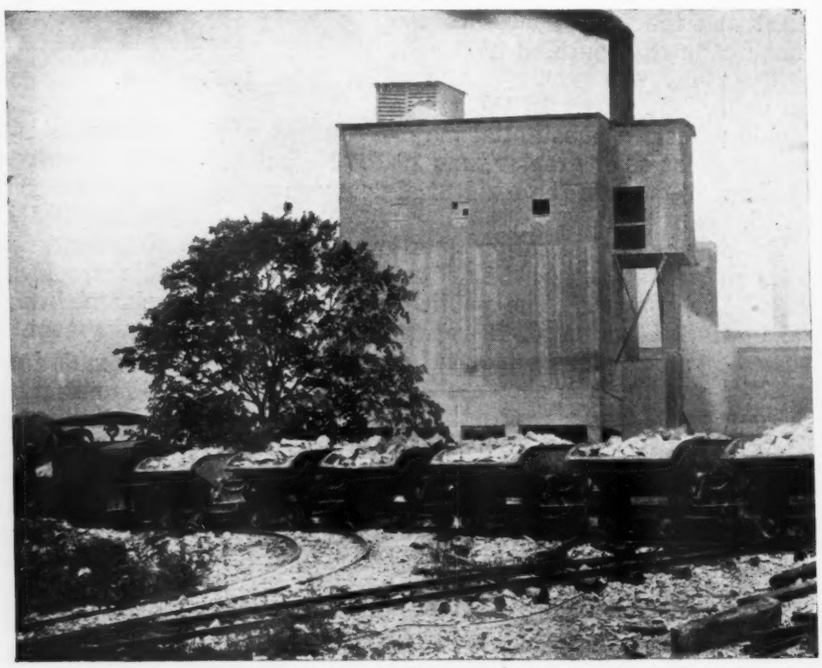
A limestone quarry usually becomes an underground operation by a gradual process of "reluctant transition," in spite of the many advantages of quarry operation. During this transition period numerous steps are taken by operators unfamiliar or unskilled in planning the resultant layout to function as an efficient unit, with flexibility, and economy, both for expansion and contraction of production. Considerable planning is necessary when changing such an operation to a more efficient unit that will yield maximum results and yet maintain production and low operating costs during the transition period. The advisability of revamping transportation at the Peerless mine was recognized about five years ago, and the improved efficiency resulting from remodeling this phase of operation has thoroughly justified the capital expenditure involved.

In 1924, rock was delivered to the top of the kilns, about 70 ft. above the mine floor, by a combination of gravity plane, mule haulage, and three steam hoists. Although the number of hoists seems excessive, each hoist was justified by certain peculiar local conditions. The first hoist pulled trainloads of rock from the mouth of the tunnel over a steep "hump," then across a bridge, and finally spotted the trainload at the foot of an incline about 150 ft. from the foot of the kilns; the second hoist took the cars up an inclined trestle which cleared the railroad shipping spurs; and the third picked the boxes from the trucks on the trestle and distributed the rock to the various kilns. Thus, each hoist seemed justified, but the scheme required an excessive transportation crew. Moreover, the gravity planes in the mine were so long that they were becoming dangerous, and minor accidents occurred because of inadequate braking equipment.

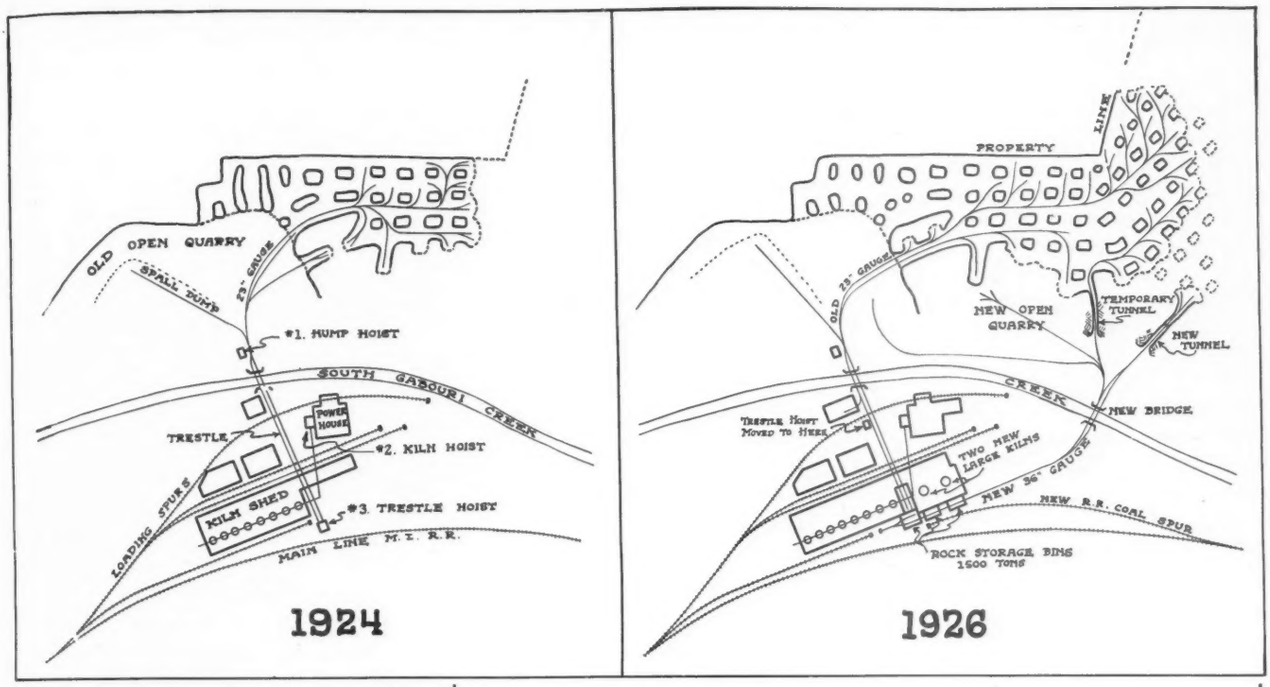
Other unsatisfactory features of the system

*Reprinted from *Engineering and Mining Journal* for May 8, 1930.

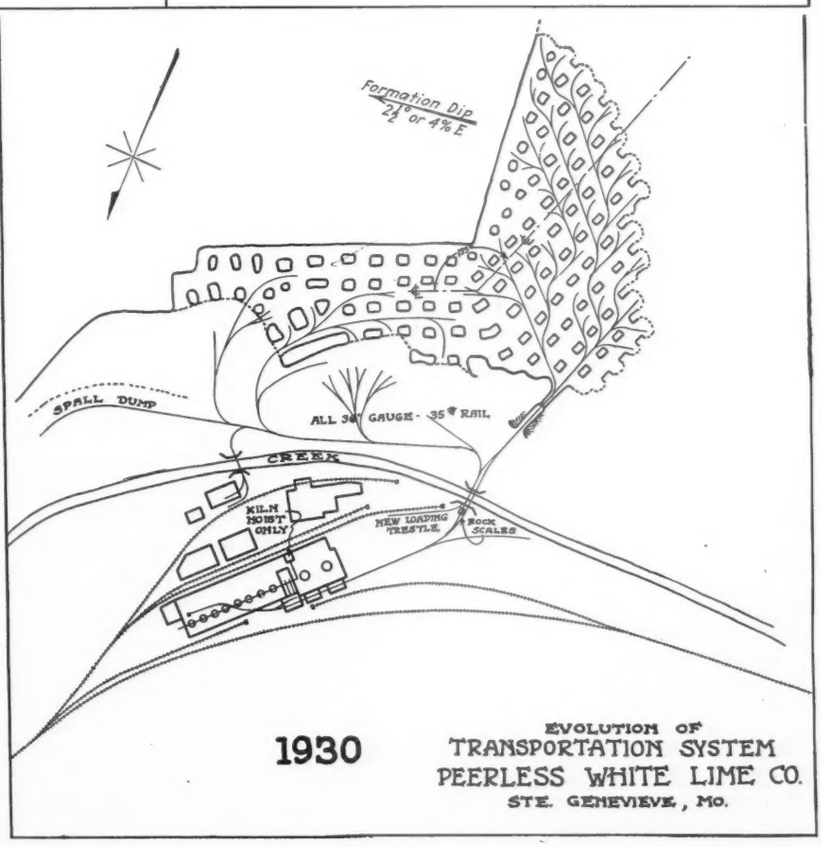




Rock boxes being hoisted into the kilns. (Right) A train of loaded rock cars from the mine.



were: A mixture of rail weights which ranged from 25 lb. to as heavy as 50 lb.; an odd-sized gage of 23 in.; various lengths of lead rails; various weights and lengths of switch points; numerous types of throws; and many different numbers, types, and weights of frogs. Another condition which needed correcting was shortage of storage capacity for kiln rock. The Peerless mine operates on a six-day week, and, inasmuch as the kilns operate continuously, rock storage facilities to take care of the period of shutdown in the mine must be available. Furthermore, a 36-hour rock storage capacity is a valuable safety factor in coping with a temporary and unexpected breakdown of equipment or a shortage of personnel. In addition to correcting these various undesirable features, any new transportation system had to combine efficiently with plans to expand the capacity of the plant; construction of two new large production kilns was begun in 1925.



The accompanying plant map for 1926 shows the primary stage of development at that time. Among the main changes are: Trestle hoist moved to foot of trestle to make room for concrete storage bin; temporary tunnel driven to nearest portion of mine workings to furnish rock supply for new kilns over wider gage track; new bridge across creek; new permanent mine entry started; replacement of quarry and mine track with new track of 36-in. gage; new open quarry started to supplement mine production; new railroad coal spur to new kilns.

By 1930 the process of transportation development had reached that shown in the map for that year. The notable features of the present layout as shown in that map are: Complete conversion to 36-in. gage; permanent entry to mine workings; kiln hoist moved close to rock bins, and only one hoist used, instead of three hoists, as formerly; new loading trestle for loading raw product into railroad cars placed in better position, eliminating

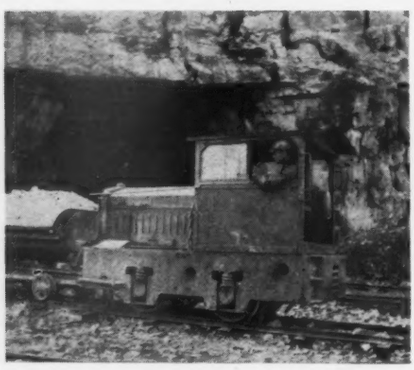
extra hoist; more direct route of rock to storage bins for kilns.

As shown in the 1930 map, the center lines of the pillars are turned 45 deg. from the early center lines, after rounding the corner of the property line, and the pillars are also staggered in one direction. This was done to reduce excessive grades and sharp curves in the mine. On account of the dip toward the east of the limestone formation, the center lines of pillars and main mine tracks in the 1924 map were on a 4 per cent up-grade toward the headings, which grade was sufficient to cause difficulty with heavy loads on sharp curves. By turning at 45 deg. with the former center lines, the maximum grades were reduced to 2 per cent, and where the main lines cut diagonally across the staggered lines of pillars, the tracks are almost level.

The parallel duplication of mine tracks across the headings reduces track laying to a minimum, because each line is used for three different mining operations and remains in place until the rock is exhausted. The first line of tracks serves the 15-ft. headings; the second line, a secondary cut to a 20-ft. parting which makes a good roof; and the third line, the final cut to the 40- or 50-ft. roof. Thus, as fast as one main track is abandoned, another is ready to take its place, and the mining, loading, and track operations can proceed on a regular routine basis with no interference from each other. Moreover, a substantial supply of broken rock and ample loading tracks are available at all times. Furthermore, development is kept well ahead of the main rock reserve.

Among the intangible items which have been improved in the transportation system and which do not show on the map are: Complete standardization of all track supplies; 35-lb. rail throughout; No. 4 plate riveted frogs, 42 in. long; 6-ft. switch points; use of standard ground throw switches, except where spring switches are used; 12-ft. lead rails; rail braces on heavy-duty curves; Koppel all-steel standard low-type 2x36-ft. rocker cars; three Whitcomb 8-ton gasoline locomotives.

Another important part of the transportation equipment are the concrete rock storage bins erected in 1926 and 1927. The productive capacity of the two new kilns is so large that it was deemed necessary to erect individual storage bins of 200 tons capacity for each kiln, so as to assure an ample rock supply for 36 hours. These bins have a bottom inclined at 45 deg., lined with sheet iron, to prevent abrasion, and equipped with a quick-opening compressed-air arc-gate and chute for filling a 5-ton skip. To provide storage for the line of eight smaller kilns, a flat bottom two-compartment reinforced-concrete bin, with storage capacity of 1,100 tons, was erected in line with the other bins. It is tapped by eight steel-lined holes, emptying into steel chutes, which are also controlled by quick-opening air-operated arc-gates. An ingenious device enables the operators of these gates to open any gate or to change quickly from one to another; and only one air cylinder is used. Rock from the chutes dumps into transferable wooden boxes placed in pairs on roller-bearing trucks, which are hand-trammed to a point directly below the kiln hoist cable, where the boxes are picked up by the hoist engineer and transferred to any kiln in the line. A further storage capacity of about 180 tons is secured by loading all rolling equipment before shutdowns. The rock storage afforded by the bins also makes it possible to fill the kilns day and night, a necessary factor on account of an increase in kiln production brought about in 1928.



Trains are hauled by 8-ton gasoline locomotives.

Standard railway switch used.

In addition to an accurate cost system kept by the St. Louis office, the plant keeps a close watch on efficiency by means of a staff-devised labor-hour production record, by which the tons per man-hour of labor are calculated on each division of labor in the mine. The comparative figures of tons per man-hour of transportation labor for the various years indicated on the plan-map give an interesting measurement of the improvement in efficiency brought about by the various changes. These figures follow:

	Tons per Man-Hour
1924, original system	3.5
1926, partly changed	4.6
1929, completely changed	5.7

Thus, an extreme increase of 63 per cent was attained in time efficiency. This has a strong influence on final costs, although not to a full extent, because of the higher wages paid for more skilled labor in part of the present transportation crew. However, the results show considerable improvement in a cost comparison, and this is the basis of the statement made in an earlier part of this discussion, to the effect that "the improved efficiency resulting from remodeling this phase of operation has thoroughly justified the capital expenditure."

Missouri Sand-and-Gravel Firm Puts New Equipment in Service

Plant on Meramec River Installs Dredge, Tug and Stiff-leg Derrick for Unloading

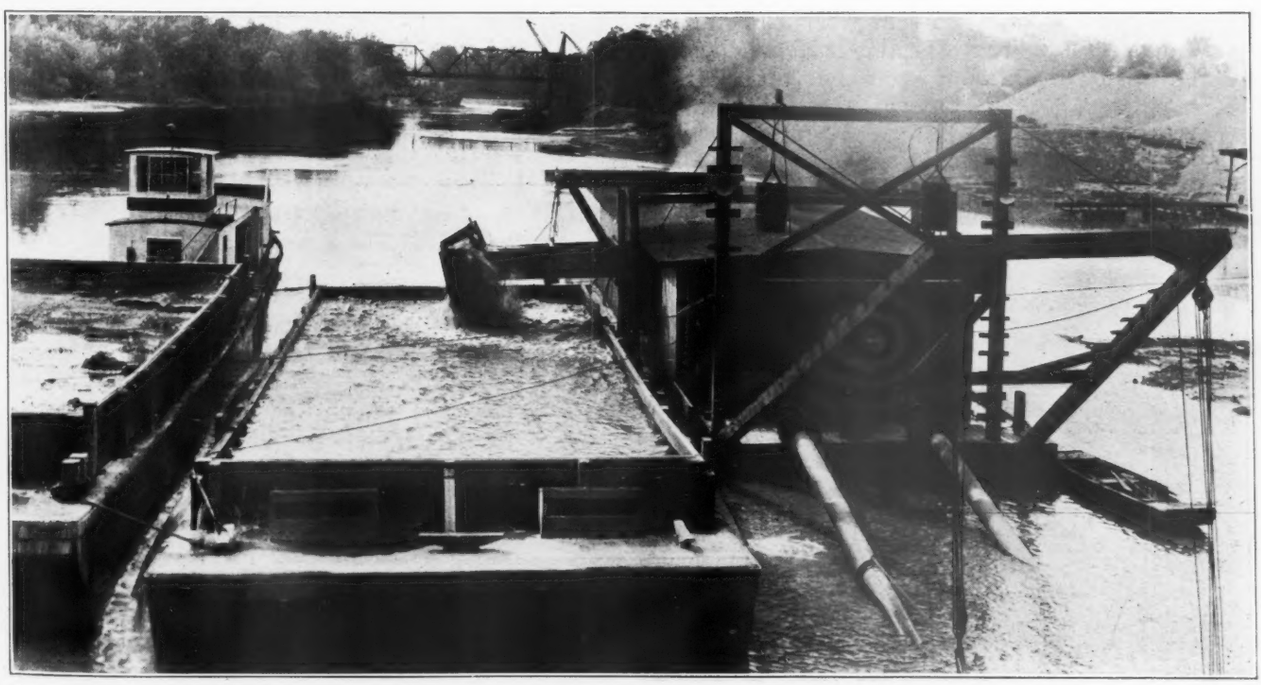
THE Denton Sand & Gravel Co., operating a sand-and-gravel plant at Pacific, Mo., on March 1 of this year, installed a dredge, a tugboat, and a stiff-leg derrick for unloading from barges. No expense was spared, and the result is one of the most complete and efficient operations now in existence at a plant of this size. The new equipment replaces an old steam dredge and tugboat.

The plant is located on the Meramec River, two miles southwest of Pacific, Mo., and about 35 miles southwest of St. Louis, which is the principal market for the material produced. A 3,000-ft. sidetrack connects the plant with the Frisco Ry., over which shipments are made.

The company's property of 155 acres borders on the east side of the Meramec River. It is being worked back from the river which furnishes water for the dredging operations. Operations have been conducted on this property for about 8 years when the first plant was built. This was abandoned after three years and a second plant was erected. Neither of these had a very large output. About three years ago it was decided to build the present plant, which has a capacity of 2,500 tons per day. That the plant was not overbuilt is evident from the fact that it is now operating two 10-hr. shifts per day to supply the demand.

The new dredge has a wooden hull and is 100 ft. long by 24 ft. wide. The superstructure also is of wood, with siding and roofing of corrugated metal, and extends almost the full length of the hull. The two 12-in. Morris dredge pumps are located side-by-side near the front of the dredge. They have a 14-in. suction and a 12-in. discharge. A 4-drum Samson hoist at the front end of the dredge handles the two 40-ft. nozzles which are supported from a stationary timber boom. The hoist is driven through a Texrope drive by a 20-hp. Fairbanks-Morse electric motor.

The dredge pumps are direct-driven by two Fairbanks-Morse marine-type, Model 35, full-Diesel, 6-cyl., 210-hp. engines operating at 360 r.p.m. These are located side by side slightly to the rear of the center of the dredge. Each engine has a Cutler-Hammer magnetic clutch, the current for which is generated by a Fairbanks-Morse d.c. generator driven through Texrope drive from the drive shaft. All electric motors on the dredge are direct-current and secure their power from the same source. The drive shafts connecting the engines to the pumps each have two Medart bearings near the motors and a Transmission Ball Bearing Co.

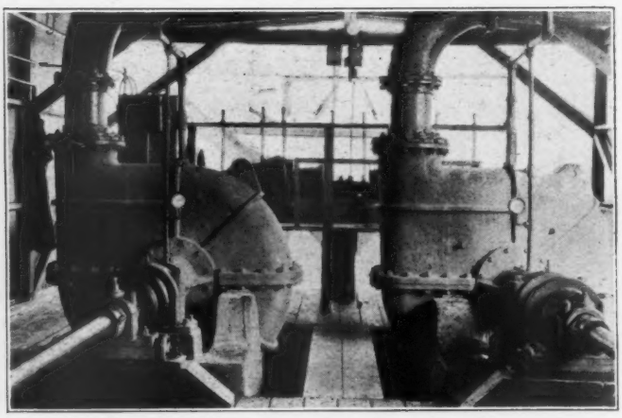


The tug "Helen Doris" with empty barge. Barge in center being loaded and third barge in background being unloaded. Note two intakes on dredge.

Close-up of plant showing screens, sand box and concrete storage bins.

bearing at the pump end. Each cylinder of the motors has an exhaust pipe running through the roof of the dredge. Each engine has a Brown exhaust-temperature indicator.

A 5-in. Fairbanks-Morse centrifugal pump driven by a 15-hp. electric motor of the same make primes the dredge pumps and can serve also as a fire and bilge pump. A 2-drum Samson hoist at the rear of the dredge operates a shore line and a barge line. This hoist is gear-driven by a 15-hp. motor. Air is stored in three tanks and is furnished by air pumps that are integral with each of the Diesel engines. A small 1-cyl. gasoline-driven Fairbanks-Morse air compressor is used as an auxiliary. Fuel



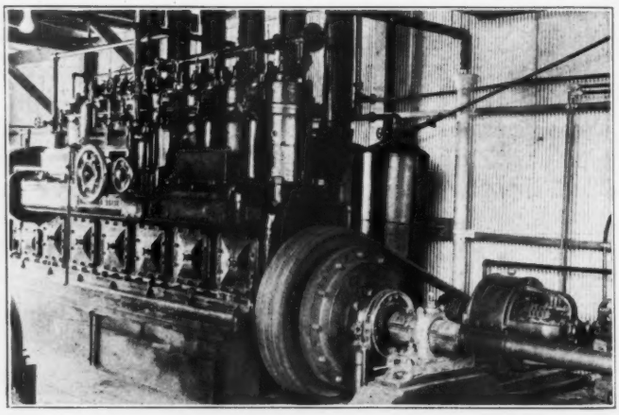
The two 12-in. dredge pumps with 4-drum hoist operating nozzles in background.

Dredge discharging into barge which is almost fully loaded.

for the engines is stored in two 750-gal. capacity tanks at the rear of the dredge.

The dredge has two pump operators—one man to attend the Diesel engines and one man to handle the barges that are being loaded. The pumps discharge through the side of the dredge into a flume with a baffle at the end which causes the material to drop vertically into the barges. Two small hand hoists on the dredge handle the flume and the front end of the barge. A 200-ton-capacity barge can be loaded in 30 minutes under average conditions.

All of the equipment on the dredge, with very few exceptions, was furnished by Fairbanks, Morse & Co. The dredge pipe was furnished by the Na-



One of the 6-cyl. 210-hp. Diesel engines with magnetic clutch and generator at right.

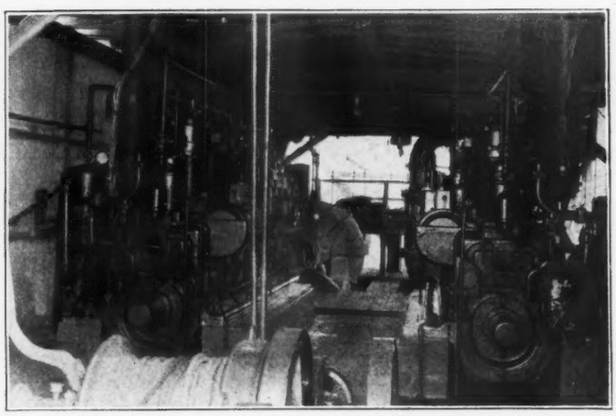
tional Tube Co. Cutler-Hammer push-button starters are used for the magnetic clutches. General Electric Co. floodlights are used for night operation.

The tug, the *Helen-Doris,* which pushes the barges to the plant, was put in operation at the same time as the dredge. It is of all-steel construction—hull and superstructure—and was built by the American Steel Dredge Co. The power plant is a Fairbanks-Morse 3-cyl., 75-hp., full Diesel engine located in a house at the front of the tug. The drive shaft runs to a Keck-Gonnerman enclosed spiral-bevel-gear drive at the rear of the boat. This drives a 12-ft. stern paddle-wheel through two wedge-type friction clutches and chain drives. At full speed the paddle-wheel operates at 28 r.p.m.

The hull is 60 ft. long by 14 ft. wide and is divided into six water-tight compartments. The pilot house is located above the engine. The engine room houses also a Fairbanks-Morse Model A 32-volt light and battery plant. This can be connected to an auxiliary air pump if necessary. There are also two air tanks and two 250-gal. fuel tanks under the engine room.

The tug boat has a reinforced structure at the bow and two hand winches for fastening a barge. The wooden barges, which have a capacity of 200 tons each, are pushed a distance of about 1,000 ft. from the dredge to the plant. Only three barges are used at present, but the fourth will be needed when operations extend further from the plant. At present, one barge is loaded while another is unloaded and a third is in transit.

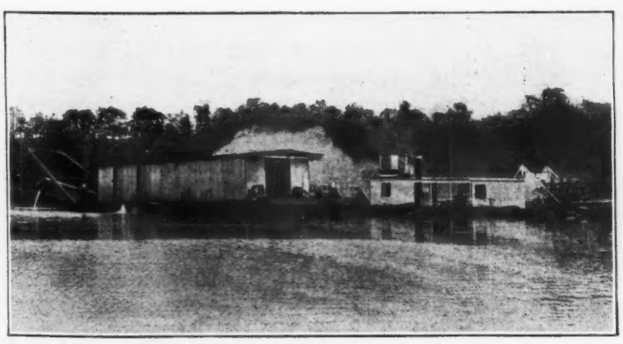
The barges are unloaded at the plant by a steel



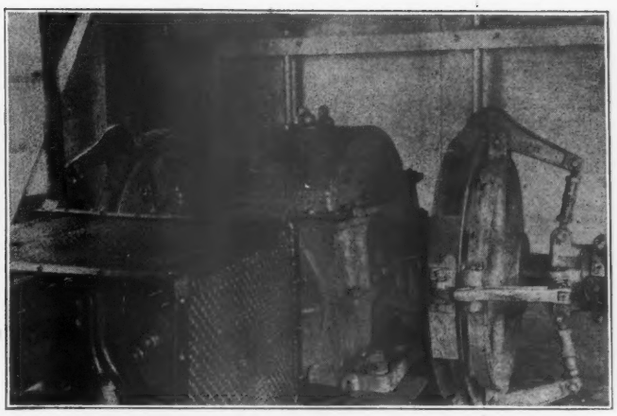
The two 6-cyl. 210-hp. Diesel engines operating the two 12-in. dredge pumps.

stiff-leg derrick built by the National Hoisting Engine Co. This is supported on concrete footings and has a wood-frame building which houses the operating mechanism. A National 3-drum hoist driven by a 100-hp. Fairbanks-Morse electric motor operates the 50-ft. boom and the Williams 1¾-cu. yd. clamshell bucket. A single-drum National hoist, driven by a 15-hp. motor, swings the boom. Cutler-Hammer controllers, Fairbanks-Morse starters, and Trumbull safety switches are used in the derrick.

The derrick discharges to a hopper feeding a 30-in. Stephens-Adamson inclined belt conveyor,



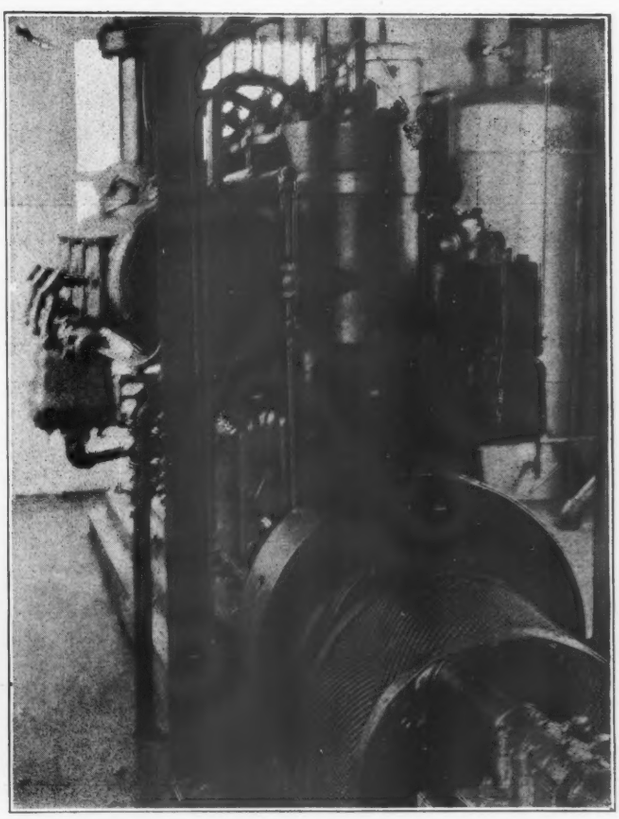
A side view of the dredge and tug-boat.



The tug-boat drive with friction clutch on each side.

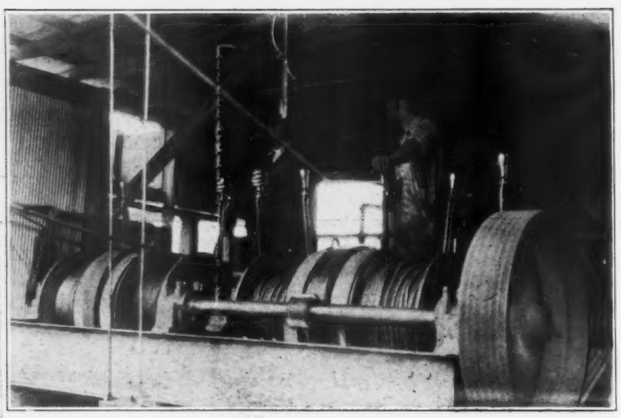
on 220-ft. centers which delivers to the top of the screening plant, where it feeds a series of three 4-ft. by 6-ft. Niagara vibrating screens. The first is a triple-deck screen with 2¼-in., 1¼-in. and 1-in. mesh. The other two are double-deck screens with ¾-in. and ⅝-in., and 5/16-in. and ¼-in. mesh, respectively. These screens were installed early this spring when the capacity of the plant was increased and replace three smaller screens of the same make.

The throughs from the ¼-in. deck go to a Stephens-Adamson sand drag-box. The various sizes produced go to a six-compartment concrete bin supporting the screening plant, with a total capacity of 500 tons. These load from one side only through Stephens-Adamson drop-chute gates into



The 3-cyl. 75-hp. Diesel engine driving the tug-boat.

The main plant building with conveyor from shore hopper. Locomotive crane loading cars from stock pile.



The 4-drum hoist with 2 operators controlling the two dredge intakes.

railroad cars on a siding. Any rehandling or reclaiming of material is done by two 21-ton steam locomotives—one a Browning and the other an Orton and Steinbrenner. An American 40-ton steam locomotive does all switching.

The office of the company is at the plant. Samuel Sall is superintendent. C. B. Denton is president and general manager.

Derrick with clamshell bucket loading from barges to plant hopper.

Salt Harvested by Huge Tractor

(*Continued from Page 26*)

tating, in which case the drum drags the salt over until it slides down onto a conveyor belt. A J.F.S. variable speed reducer controls the speed of the drum and hence the amount of salt fed. Two spirals are welded on the drum to break lumps of salt and a shear-pin coupling takes care of tramp iron.

A screen basket elevator drops the salt into a continuous centrifugal dryer, from which it is elevated to the top of a second set of bins to be screened as the trade demands. The shipping grades are usually sacked from platforms below the bins, but provision is made for shipping in bulk if required.

Salt that has drained at least 3 to 4 months is loaded from stock by the crane into bottom-dump gondolas of about 60 tons capacity and deposited in the track hopper for use in this plant. At present ordinary platform scales are used, and all sacks filled from spouts. Hand trucks are used in loading. Provision has been made to add automatic scales with sewing machines and conveyor loaders.

Capacities of the various units per hour are as follows: harvesting, about 175 tons; first washer, 225 tons; rewasher, about 50 tons. The entire plant was laid out to ship an average of 500 tons per day. In the salt business, this may run to a peak of 1,500 tons per day.

Analysis of Dust Problems Important In Choosing Type of Equipment*

Laboratory Tests of Dust-Laden Gases Determine Efficient Collecting Method

WHERE a dust problem exists its successful solution is largely dependent on the proper selection of dust-collecting equipment. However, before such a selection may be made, each individual case must be made the subject of a careful and comprehensive survey and the data, thus obtained, thoroughly studied in connection with the results which may reasonably be anticipated when using various types of collectors.

As it is almost impossible to draw direct parallels even between similar operations, concrete information must be obtained, thus determining the conditions under which collectors will operate and specifically covering the following points:

1. The application.
2. Dust characteristics.
3. The volume and temperature of the gases.
4. The dust-loading of the gases.
5. The relative humidity of the gases.
6. A chemical analysis of the gases.

Accurate determination of the above factors is vital and cannot be overemphasized, as the successful design of any dust-collecting system is directly dependent upon them, and an unsatisfactory installation and financial loss may occur unless true operating data is available. For satisfactory results every dust collector must be individually designed to meet the requirements of some specific application.

Because of the necessity of having such data and the protection it affords the purchaser, each of these factors will be briefly discussed so as to indicate its relative importance in the solution of the problem.

Application

The points of application are innumerable and each point of application has in itself a wide variation of conditions. As an illustration, let us assume an installation on rock dryers in a cement plant. One would naturally assume that the application was, in all cases, common, but, to the contrary, many variables enter into the problem which require a thorough analysis before proper application can be made.

In a cement plant, one installation of rock dryers may be operating on rock having a low moisture content—another installation may have a high moisture content. The rock dried in one installation may be of a very crystalline structure. In another it may be of a flat, scaly structure, similar to slate or shale. A type of dryer may be used where most of the heat is utilized, with the result that the temperature of the gases is low. On another type, the temperature of the escaping gases may be treble or quadruple that of the first application. On one dryer installation the structure of the rock may be such as to give a comparatively small amount of fines, with the result that the dust loading of the gas is light. On another the structure of the rock may be such that the loading of the gases is extremely heavy. All this means that what will prove a successful application in one case may be a failure in another case.

The fineness of the dust particle, the shape of the dust particle, the weight of the dust per cu. ft., the loading of the gas, the temperature of the gas and the percentage of moisture in the gas all have pronounced bearing on the successful application of dust collectors to these units. In all other applications there are as many variables found, and each of these variables should be known and understood before final decision is made as to the type of collector to be installed.

It is a great mistake to assume that because a collector has been successful in one application, the same equipment will give satisfactory results, even on the same application in another plant, and a decided fallacy to assume that it will give the same satisfactory results on an entirely different application.

Although direct parallels cannot be drawn, it is, nevertheless, of great importance that the particular application in question be fully described in requesting bids on dust collectors. The manufacturer who has had ample experience with dust problems can draw valuable inferences from such descriptions and will immediately appreciate the peculiarities which must be looked for.

On dust-collecting equipment the purchaser must learn to depend upon the knowledge and recommendations of the manufacturer to the same extent that he depends upon the knowledge and recommendations of the manufacturer of any other successful and first-class piece of equipment. Furthermore, the manufacturer of dust collectors should definitely stand back of his equipment with guarantees which will protect the purchaser.

Dust Characteristics

By the characteristics of the dust is meant its shape, fineness and density.

Dust particles may be globular, granular, or flocculent in form. A microscopic examination should be made to determine this, as the rate of fall or terminal velocity of the dust particle is governed partly by its shape. The terminal velocity

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*Abstracted from *Dust Problems*, Dust Recovery, Inc., New York, N. Y.

of the dust particle has a decided bearing upon the question of dust nuisance in the neighboring vicinity. It also has a bearing on the design and efficiency of a dust collector for that particular application. A high terminal velocity generally increases the efficiency of a mechanical type collector, so, if an extreme degree of efficiency is not desired, and the terminal velocity is high, the apparatus may be designed so as to give the required results at a much lower cost. In all cases, the more information obtained regarding the dust characteristics, the more successful should be the dust-collecting apparatus.

However, there is a considerable difference in the terminal velocity of a dust particle which has been trapped and handled and that same dust in its live state as it exists in the gases from the boiler furnace, kiln, etc. In the latter state, each particle is enveloped in a film of gas, and for this reason the terminal velocity of the dust particle will in many cases be considerably retarded, this condition being dependent upon the size, shape, weight and composition of the dust particle and by the characteristics of the gas in which it is being carried.

The fineness of dust needs little discussion. Screen tests can be made according to standard procedure and the results stated as certain percentages remaining on or passing through sieves of different mesh.

One other fact relative to dust itself should be considered and that is the weight per cu. ft. When we speak of the weight per cu. ft. we do not refer to the density of the dust itself. We refer to the weight of the dust in the state in which it is taken from the gas stream and poured into a receptacle. It should be noted that this dust naturally is loosely packed, and, as it has just been taken from the gas stream, it is in its live state to a certain degree. Should this dust in the receptacle be allowed to stand for several hours, or several days, it would gradually pack, so that after a short period this same dust may only occupy 50 to 70 per cent of the original cubical space. The reason for this is the gradual filtration of the adherent gas out of the mass through settlement. This same sample could further be reduced in volume, through shaking. Its bearing on collector design lies in the fact that heavier dust particles will be more readily trapped, so it will be evident that the weight per cu. ft. of dust must be considered in its live state, as it would actually pass through a collector.

From a financial standpoint, the volume of dust escaping to the atmosphere and its value to the plant should be determined. In this manner it becomes possible to estimate the probable return on the investment in dust collectors, this naturally being based on the efficiency guaranteed by the manufacturer.

Gas Characteristics

Under the above heading we are interested in the gas volume, temperature, chemical characteristics, dust loading and relative humidity. All of these factors must be determined. The gas volume and dust loading establish the size of the apparatus required. The temperature and chemical characteristics of the gas may be such as to require the use of special metal in the construction of the apparatus, while the humidity of the gases further restricts the selection and may be such as to necessitate insulation of the collector and ducts.

Accurate determination of the volume of gas on which the collector is to operate is just as necessary as determination of the horsepower required to operate any unit in the plant. The size of all dust collecting units of every type is based on the volume of gas to be handled. If that gas volume is found to be in excess of what was anticipated, unpleasant results will occur. On the filter type collectors, or on the cyclone type collectors, high pressures will result to the extent that it will probably be found that the fan and motor is not of sufficient size to handle the volume required. On electrical and some mechanical collectors, while the pressure conditions may not become excessive, the efficiency of the apparatus will invariably be reduced. For these reasons the maximum gas volume should be obtained and the collector designed to handle this maximum volume. On the other hand, guessing at the maximum volume and protecting oneself by a liberal safety margin will invariably lead to an expensive installation and to high power requirements, which in turn will greatly reduce the return on the investment.

The gas volume can be closely obtained by carefully taking Pitot-tube and temperature readings in a suitable location and then checking this against the theoretical volume of gas produced. This is the only way to accurately determine conditions. It will immediately establish data indicating whether or not the system is in good operating condition. Very often it will bring to light innumerable unnecessary leaks which, when corrected, will not only increase the efficiency of the operation, but also reduce the gas volume and permit of the use of smaller dust collectors. Where the gas consists primarily of the products of combustion, as is the case in boiler furnaces, its volume can be closely estimated from the combustion data. In such cases, however, it is well to check results with the fan data. This would consist of the size, type and make of fan, the total pressure or suction under which the fan operates, the temperature of the gas at the fan, and the r.p.m. and horsepower of the fan.

In every case, however, the best possible safeguard is to measure the actual gas volume under various conditions of plant operation by means of the Pitot tube.

In taking Pitot-tube readings it is advisable to use a good tube of standard manufacture, and particular attention should be paid to the static holes, as they are very liable to clog with dust, thus throwing the readings off, particularly if the gases contain a high percentage of moisture and if the tube is cold when placed in the gas stream. This

condition can often be overcome by heating the tube just before placing it in the gas duct. The velocity opening of the tube should always face the gas flow squarely, otherwise an incorrect reading will be obtained.

It is advisable to use a good grade of manometer, at least 12 in. long, and accurately calibrated. Where the velocities are low it is often advantageous to place this manometer at an inclination of 5 to 1, in order to get more accurate readings. Where the velocities are very low, an inclination of 10 to 1 should be used. Experience has proven that the best liquid to use in a manometer is benzine colored with alkanette, or any other easily soluble and brilliant coloring medium. This liquid is very active, is susceptible to the slightest variation in pressure and will not gum or get sluggish. Being colored, it is easily read. The specific gravity of this liquid should be obtained so as to permit conversion to water readings and compensation must be made for whatever inclination is used. All readings should be reduced to and stated in "inches of water."

Much has been said about the proper method of handling the Pitot tube to obtain the most accurate readings.

Technically speaking, the proper way is to accurately divide the duct, either round, square or rectangular, into several parts of equal area and to then take readings in the center of each of these divisions. The average will then give an approximation of the average for the total area. This method is, undoubtedly, the most accurate, provided the walls of the duct are clean and there is no eddying or banking of the gas stream. In most installations, however, these conditions arise and it has therefore been found that, in actual practice, it is always advisable to thoroughly explore the full cross sectional area of the duct by taking a large number of preliminary readings and, from these, establish the individual characteristics of the gas flow at each point. It is then possible to plot out the results and establish one or more points, dependent upon the size of the duct, at which future mean readings may be taken. With a little study and practice one will become so accustomed to local conditions as to be able to handle the problem with confidence.

The temperatures observed when taking Pitot-tube readings are not only necessary in order to obtain the correct gas velocity and volume, but will indicate a limiting factor with respect to certain types of dust collectors. For example, cloth filter type collectors can not be used at elevated temperatures.

It is of course understood that with the velocity head, in inches of water, and the temperature of the gas obtained, the gas velocity at the point of measurement can be determined either by formula or from charts or tables. The velocity multiplied by the sectional area of the duct gives the gas volume, which is conveniently expressed in cubic feet per minute.

The term "loading" is generally expressed in grains (avoirdupois) of dust per cubic foot of gas. This defines such terms as dust loading of the gas, dust loading and gas loading, all of these meaning the weight of dust per cu.ft. of gas at a given temperature and pressure.

Several methods of determining this loading have been developed by the U. S. Bureau of Mines and others. These are briefly outlined as follows:

The impinger method is being used at the present time for determining rock dust in air. The impinger is simply a glass nozzle through which air is drawn at the rate of 1 cu.ft. per minute, with the air discharging in water against a flat plate held 5 mm. from the end of the nozzle. The impinger and the plate are supported in a 16-oz. bottle which also holds the water. The impinger and the method of using it are fully described in the paper, S. H. Katz, G. W. Smith, W. M. Meyers, L. J. Trostle, and M. Ingels, "Comparative Tests of Instrument for Determining Atmospheric Dust," U. S. Public Health Service, Bulletin No. 144, 1925, 69 pages.

The sugar tube method of determining rock dust in air was used by the Bureau some years ago. It has been discarded for the impinger method because the sugar-tube is less efficient as a dust catcher than the impinger. The method consisted of drawing a measured quantity of air through 100 g. of pure granulated sugar held in a glass tube 2⅜ in. in diameter. Dust was caught in the sugar which was taken to the laboratory. The sugar was dissolved in water and the insoluble dust remained in suspension and was filtered from the solution. The paper filter was washed, dried and weighed, or if the dust was non-combustible, it was burned from the dust, which was weighed. This method is described completely in the paper, A. G. Fieldner, S. H. Katz, and E. S. Longfellow, "The Sugar Tube Method of Determining Rock Dust in Air," Bureau of Mines, T. P. 278, 42 pages.

The Palmer apparatus has been used in some work at the Bureau. It consists of a large, pear-shaped glass bulb, at the bottom of which is a U-tube of about 1 in. internal diameter. About 40 or 50 c.c. of clear water is put into the tube and air or gas is then drawn through the apparatus at the rate of about 4½ cu.ft. per minute. The air breaks the water into a spray in the bulb which washes dust from the air. After a sufficient quantity of air has been passed, the dust may be filtered from the water and weighed as in the sugar-tube method. The Palmer apparatus is described in Public Health Service Bulletin 144, reference above.

An alundum thimble method for determining soot and tar in hot gases was used to study furnace gases. The hot gases are drawn from a furnace through a glass-lined, water-cooled tube inserted into the furnace. At the outer end of the sampler the dust catcher is attached. It consists of a glass tube open at the bottom and closed at the top with a rubber stopper to which an alundum thimble is attached. A bent glass tube passes through the

stopper and into the thimble. The bent glass tube is attached by means of rubber tubing to the gas sampler. Suction is applied at the open end of the first mentioned glass tube. Air from the furnace passes through the glass liner of the sampler and some tar and soot is caught here. Residual tar and soot are filtered on the inner surface of the alundum thimble. In case the material caught tends to stop the filter, the stopping can be lessened by putting into the thimble some loose asbestos fiber. The thimble can be weighed before and after catching dust or the material caught may be recovered by chemical methods and determined. This method is described in the paper, S. H. Katz, "Tars Distilled from Bituminous Coal in Hand Fired Furnaces," Bureau of Mines, T.P. 195, 1918, 20 pages.

A filter paper method of determining tars in gases has been devised by the Steere Engineering Co. of Detroit. They call their apparatus a tar camera. It is very simple, consisting simply of a clamp for holding a chemical filter-paper through which gases can be drawn. The amount of suspended matter in the gases is determined by the stain on the paper or the paper may be weighed; or if the matter caught is incombustible the paper may be burned off and the residue weighed. The method is described in the paper, S. H. Katz, and G. W. Smith, "Determination of Suspended Matter in Gases by Collection on Filter Paper," Bureau of Mines Report of Investigations No. 2378, 1922.

A method of electrical precipitation has been employed. A glass tube about 1 in. internal diameter and about 15 in. long is generally used. Centered in the glass tube is an electrode of fine metal wire, usually platinum, although other metals may be used. Another electrode of metal foil is wrapped around the glass tube. The two electrodes are connected to the secondary terminals of a 15,000-v. transformer, usually of a 500-w. capacity which steps the voltage up from 110 v. Voltage in the secondary may be controlled by a rheostat in the primary circuit. Air is passed through the tube at the rate of about 1 cu.ft. per minute and suspended particles are precipitated principally on the central electrode. This method is described best in the paper, P. Drinker, C. E. Thomson and S. M. Fitchet, "Atmospheric Particular Matter II, The Use of Electric Precipitation for Quantitative Determinations and for Microscopy," Jr. of Ind. Hyg., Vol. 5, 1923, pages 162-85.

The principal fault of these various methods can be most readily explained by the statement that they are laboratory methods. As very small gas volumes are handled, the measurements must be made with the utmost precision, and this is not always feasible in the field. Another disadvantage because of the small gas volume lies in the fact that the results obtained on such tests cannot safely be applied to the total gas volume, which in many industrial cases will run up to 100,000 cu.ft. of gas per min. or more. These objections do not exist in the case of the bag test, described hereinafter, as large quantities of gas and dust are handled. It is therefore strongly recommended that the bag test be employed in order to determine the dust loading of gases. As this is a factor in determining the operating efficiency of a dust collector, this bag test should likewise be used when running acceptance tests on a commercial installation.

Bag Test

When large volumes of gas containing heavy dust loadings are encountered, the simplest and most effective method of test is that commonly called the "bag test." In this method comparatively large volumes of gas are handled, thus more closely approximating operating conditions and thereby permitting more accurate measurements as to volume of gas and closer representative samples of gas and dust.

Briefly stated, this method consists in extracting a certain volume of gas from the main gas stream and then passing this gas through a number of bags in which the dust is filtered from the gas, these bags being weighed before and after the test, so as to determine the exact amount of dust in the gas. Where the gas has a high moisture content and precipitation occurs, it is necessary to dry the bags and contents before weighing.

While the bag test will not operate at 100 per cent efficiency, it is sufficiently accurate for industrial purposes, as practically all of the dust particles are trapped.

During the test it is necessary to take periodical Pitot readings and temperatures, both in the main gas stream and in the stream of extracted gas, so as to establish the gas volume in both cases. As there is liable to be a considerable temperature drop in the extracted gas, this should be compensated for in determining the actual dust loading.

The percentage of gas used in the test should be at least one per cent of the total volume, and, if possible, two or three per cent.

The intake of the test flue should be placed directly in and facing the flow of gas in the main flue. The velocity of the gas entering this intake should be the same as the velocity in the main flue, otherwise the loading of the gas will be thrown out of balance. This is readily explained as follows:—

With the gas flow equal at both points there is no disturbance of the gas stream which would create either a suction or banking of the gas at the intake. The flow being constant and without disturbance, the dust particles maintain their relative position in the gas stream and the loading remains constant.

Should the flow of gas entering the intake be slower than that of the main stream, a banking condition will occur with the result that a considerable portion of the dust carried in the higher velocity gas will be projected into the slow-moving stream, thereby increasing the dust loading at that point.

Should the velocity at the intake be higher than that of the main gas stream, a suction will be

created. This suction draws the gas in over the edges of the intake, while a large portion of the dust particles, due to their initial velocity and heavier weight, will be projected past these edges and carried along in the main gas stream, with the result that the loading of the gas entering the intake of the test apparatus will be less than the loading in the main gas stream.

To maintain a condition where the velocity of the gas is equal at both these points, it is almost invariably necessary to use an induced draft fan on the test apparatus, as the pressure set up in the test ducts and bag filters is generally higher than the existing pressure in the main flue. It is, of course, always necessary to use an induced draft fan where the test apparatus is located at a point ahead of induced draft fans operating on the main flues.

The most important factor in obtaining correct gas loading by the method above outlined or by any other method, is the location of the test apparatus intake in the main flue.

As previously stated, this intake should always face the gas flow. It should also be located at or near the end of as long a straight run of flue as possible, otherwise the gases, in banking on any bends in the main flue, will have a decided tendency to precipitate a considerable part of the heavier dust particles along the outer side of the bends, thus upsetting the uniform loading of the gases at, and for a considerable distance past the bend.

Furthermore, as the gas stream travels along the flue, there is also a natural tendency of the heavier dust particles to precipitate to and be carried along the bottom of the flue, so that in this case the dust loading of the gases will be lowest near the top of the flue and heaviest at the bottom. This condition is more readily obtainable in a long horizontal run of straight flue than in a flue containing several bends, as the banking of the gases at each bend creates eddies which have a tendency to keep a large part of the heavy particles in suspension.

Assuming an ideal condition of a straight run of flue equal to at least ten diameters of the flue, the first step would be to establish an imaginary vertical center line in this flue, to subdivide this center line into four equal parts and to then take four tests with the test intake located on this center line at points in the center of each subdivision. An average of these readings should very closely approximate the average loading of the full volume of gas, while that individual reading which most closely approximates the average of the four readings would very closely establish the position at which to place the intake for further tests, provided the factors of volume, velocity and temperature of the main flue gases remained constant.

If the construction of the main flues is such that no straight runs of any great length can be obtained, it is then necessary to select the most suitable location obtainable and to subdivide the total area of this flue into at least nine sections of equal area, taking individual tests in the center of each of these areas and then averaging the total readings. Even then, eddies, changes in velocity or volume, or other factors, may constantly change conditions in these areas to the extent that no two readings in the same area will show the same results and also to the extent that the average loading will only be an approximation.

The ducts of the test apparatus should always be of such size as to maintain a fairly high velocity, 5,000 ft. per min. or thereabout. This gives a condition in which any great settlement of dust in these ducts is eliminated. The test ducts, fan, etc., in fact, the entire test apparatus, should be thoroughly cleaned before starting each test and immediately after each test, and all dust removed from these points after the test should be weighed with the dust trapped in the bags. All joints should be made airtight.

The duct to the test machine should have a straight run of at least ten diameters of pipe before entering the fan (20 diameters is preferable). The Pitot readings should be taken at a point about one diameter before the fan. The thermometer readings should be taken as close to the main flue as possible, as the temperature drop between the main flue and the test fan is usually so slight as to require no compensation. However, in case the fan is located so as to necessitate a long run of test duct, then temperature readings should also be taken at the point near the fan where the Pitot readings are taken. The control damper should be located as close to the fan as possible on the outlet side.

In order to compensate for the difference in velocity in the main flue and in the test apparatus flue it is necessary to construct the intake of the test flue in the shape of an expanding bell, the mouth of this bell to be adjusted so as to give the same velocity at that point as is carried in the main flue. The fan should be of any good make of high speed, induced draft type.

Thermometer and Pitot readings should be taken in the main flue, just before the start of each test. The damper on the test apparatus should then be adjusted so as to give the same velocity at the entrance to the test intake bell as was obtained in the main flue. Pitot and temperature readings should be taken every fifteen minutes, both in the main flue and in the test flue, during the entire period of the tests, and, if any changes in velocity are found, the damper should be readjusted accordingly.

The test fan outlet duct should be made as short as possible and should terminate in a manifold with a sufficient number of outlets to accommodate the proper number of bags to give correct filtration of the gas without creating too high a back pressure. This, to a great extent, makes the size of the bags dependent upon the type of filtering material used and the gas volume through them.

Where the temperature of the gases will permit, 400 deg. F. or under, it has been determined that either heavy Canton flannel or unbleached muslin

bags will give excellent results. These can be made of 8-oz. material. If Canton flannel is used, the bags should be made with the nap, or fuzzy side, on the interior. By maintaining a filtering area of one square foot of bag area to every three cubic feet per minute of gas, a good filtering condition will result. A convenient size of bag is about 2-ft. diameter by 12 ft. long, which can be readily made by taking a piece of 72-in. by 12-ft. material, and, after folding lengthwise, running a double stitch along the side and one end. The bag is then turned, with the seams inside, and the open end securely fastened around one outlet of the manifold.

With a test apparatus handling approximately 1,000 cu.ft. per min., five bags of the size mentioned would be required. These bags should be thoroughly cleaned and weighed before and after each test. If the gas being tested is heavily saturated with moisture, it is advisable to dry the bags immediately after each test and before weighing. In those cases where the temperature is so high as to cause the cloth bags to burn, it is either necessary to use a high grade asbestos cloth or to make the run of test flue sufficiently long to cool the gases below the danger point.

The duration of each test is dependent upon the loading of the gas. Where this loading is fairly heavy, 5 g. per c.f.g. or over, the test can be limited to two hours, or even less. Where the loading is around one grain, or less, the test should run at least four hours. Several tests should be run in sequence and a general average result secured.

Three factors must be determined in conducting the bag test, namely:—

(a) The temperature and volume of the gases through the main flue.
(b) The temperature and volume of the gases through the test apparatus.
(c) The net weight of dust caught in the bags.

The determination of dust conditions in the main flue is then arrived at as follows:—

The total weight of dust carried by the main gas stream during the period of the test is equal to the net weight of dust trapped in the bags multiplied by the ratio of gas volumes through the main flue and through the test duct.

The dust loading of the gases in the main flue is the total weight of dust carried by these gases during the test period divided by the total gas volume in this period. It is generally expressed in grains avoirdupois per cubic foot of gas at a certain temperature.

The screen analysis of the dust trapped in these tests will very closely approximate the average screen analysis of the dust carried in the main gas stream, except that it will be slightly finer. This is accounted for by the fact that the heaviest dust will always settle to the bottom of a flue and either remain fixed or slowly drift along in much the same manner as sand drifts before the wind.

Having obtained the loading of the gas, and representative samples of the dust, it is then a simple matter to obtain the weight per cubic foot and the screen analysis of the dust.

Humidity

The moisture content and temperature of the gases will determine the necessity for introducing means for keeping the gas temperature above the dew point so that precipitation cannot occur within the collector. Moisture content is generally expressed in grains per cu.ft. of gas or as relative humidity, the latter, from the standpoint of selection of dust collectors, being somewhat more to the point. This factor is of particular importance in connection with dryers of all types since the gases are generally heavily laden with water vapor and in certain cases may be so close to the saturation point that a slight drop in temperature will cause precipitation, this resulting in faulty operation for which the collector cannot be blamed.

It will be realized that where there is a possibility of precipitation, the data obtained should cover the most unfavorable conditions, that is, the maximum amount of water vapor present in the gases at any time during the operation and, also, the lowest temperatures experienced, both for the gases being handled and for atmospheric conditions. A given installation may function perfectly during mild weather, even though the gases are near the dew point, but a cold snap and the low temperatures occurring during the winter months may cause a sufficient drop in temperature to cause precipitation.

Several methods for overcoming this difficulty are available. Probably the simplest, particularly where conditions are not unusually severe, is the proper insulation of the collector and the flue connections. In other cases, it may be necessary to either introduce hot gases from the furnace into the gas stream being treated, or circulate such hot gases through a jacket surrounding the collector. Both of these methods have proven satisfactory in connection with calciners and gypsum kettles.

Chemical Analysis

A chemical analysis to determine the constituents of the gases is generally advisable and at times necessary. If this data is not on hand, or should there be a question as to its accuracy, it is always desirable to accurately determine the analysis when considering the purchase of collectors.

Such an analysis will determine the necessity of using a collector constructed of special material to cope with unusual corrosive conditions if they exist. On such operations as are known to produce no corrosive fumes, an analysis will give valuable combustion data from which the gas volume may be determined and compared with the results obtained from Pitot readings. The CO_2 analysis determining the amount of excess air present in gases of combustion very often leads to the discovery of leakage and improper firing conditions which, when corrected, insure more economical

plant operation. Likewise, such corrections will decrease the total gas volume present and, accordingly, the size and price of a dust collecting installation. . . .

Cement Plants

As a whole, the dust nuisance originating from dry-process cement plants is probably more acute than in any other industry. The sources of the nuisance are as follows:

1. Dryers, elevators, conveyors and bins.
2. Raw mills, elevators, conveyors and bins.
3. Kilns with or without waste heat boilers and coolers.
4. Clinker mills, elevators, conveyors and bins.
5. Pack houses.

Each of these has its own peculiar problem, but in none of them is the problem difficult of solution.

The gases coming from the rock dryers range from 6,000 to 30,000 cu.ft. per min., depending upon their size. These gases carry a rather high dust loading, which will vary from six to twenty grains per cu.ft. of gas, and in addition, a considerable percentage of moisture. In most cases the gas temperature is sufficiently high to assure that the precipitation of moisture will not take place within a collector, except under extreme conditions. Where these conditions exist, precautions must be taken to eliminate them. As the loading is comparatively high, a serious dust nuisance is created and steps must accordingly be taken to overcome it.

It has been determined that rock dryer dust will average about 90 per cent through a 200-mesh screen, but because of certain other characteristics, it is more difficult to trap than most other dusts of like fineness. The result is that a satisfactory collector must show an efficiency of from 90 to 95, and be of such design that the presence of moisture will not interfere with its continuous successful operation.

In the raw grinding department the mills, elevators, conveyors and bins can readily be ventilated and the combined gases passed through a suitable dust collector. In the grinding operations a considerable amount of moisture is sometimes driven off. In warm and mild weather this moisture is not bothersome, as the temperature is sufficiently high to prevent condensation. In extremely cold weather, however, there is a tendency for condensation to take place in the ducts leading to the collector, particularly when the mill is started up after being shut down for some time.

The characteristics of the dust and gases from cement kilns has previously been touched upon. The actual gas temperature will vary widely, depending upon firing conditions, the percentage of excess air and more particularly upon whether waste heat boilers are installed or not. Where they are installed the temperature of the gases leaving them is sufficiently low to permit the use of an all-steel collector.

In order to illustrate the volume of dust which is lost and the return which may be expected from the installation of collectors, let us assume an average sized dry process plant of 5,000 bbl. capacity per day. Here the average loss per day would be approximately as follows, depending upon the size, type, etc.

Dryers—30 tons per 24-hr. day.

Raw mills, elevators, conveyors, bins, etc.—10 tons per 24-hr. day.

Kilns, without waste heat boilers—130 tons per 24-hr. day.

With waste heat boilers—100 tons per 24-hr. day.

Clinker mills, elevators, conveyors, bins, etc.—10 tons per 24-hr. day.

Packing machines—8 tons per 24-hr. day.

Total loss without waste-heat boilers—188 tons per day.

Total loss with waste-heat boilers—158 tons per day.

This dust will vary in value from $1.00 per ton, at the point where it enters the kilns, to $4.00 per ton after leaving the kilns.

This, in an annual operation of 300 days per year, establishes the total value of dust loss from all sources at $72,600.

In all the cases mentioned at least 90 per cent of the dust can be trapped and returned to the system, which means a saving of approximately $65,340 per year. On the basis of a 25 per cent gross annual return $261,000 could be expended on dust collecting equipment with good results. Actually, this expenditure would be much lower.

In wet-process plants dust originates at numerous of the aforementioned points, although it is less acute on certain operations. However, an analysis as outlined above can readily be made and the estimated dust loss as well as the annual return on an investment in dust collectors readily calculated.

Gypsum Plants

It has always been a difficult procedure successfully to trap the dust originating from dryers, calciners and kettles in gypsum plants, as the dust is extremely fine and light and the gas contains a high moisture content. This gas, at certain periods in the process, particularly on kettles, may be practically 100 per cent water vapor. If this vapor is allowed to condense it will clog the collector by moistening the gypsum and causing it to set.

Quarrying of Granite in Germany Suffers Severe Slump

A critical reversal has been recently experienced in quarrying of granite in Germany, compelling the dismissal of 7,000 out of a total of 8,000 laborers employed and the closing of many old quarries that had been in operation for nearly a century. Lack of funds to build roads in Germany and keen competition from Swedish and Czechoslovak granite in foreign markets are given as the reasons for this situation.

Development of the Separating Partition Walls of Compartment Mills*

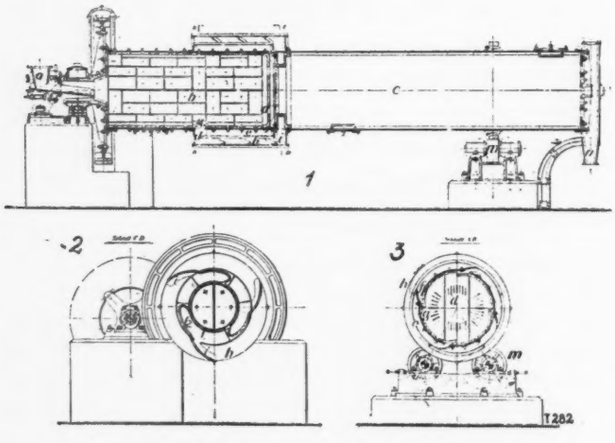
By CARL NASKE
Charlottenburg, Germany

THE compartment mill, as is well known, is a combination of the preliminary-grinding ball mill and the finish-grinding tube mill in one machine. Since the tube mill, as the second and last compartment of a compartment mill, must receive (if the length of its grinding shell shall not grow out of proportion), only a material of narrowly-limited particle size (fines), there falls, therefore, to the preliminary-grinding chamber the task of delivering as much correctly prepared material as corresponds to the maximum capacity of the second, or fine-grinding, compartment. In the shell surrounding both the first and second chambers or organically combined with it, there must be introduced a device which not only forms the boundary between the two spaces, but also allows the product of the first compartment, so far as it meets the requirements, to enter the second compartment. At the same time it must retain the too coarse particles (oversize) in the first compartment until these, in consequence of continued grinding, have reached the prescribed degree of fineness.

The problem which the machine designer had to solve was not of quite simple appearance, for, as mentioned above, the separating device should form an organic constituent of the mill shell itself, and was consequently bound in every respect to the dimensions of the latter. Until the appearance of the first compartment mill we were accustomed to work with ball mills provided with screens. It seemed natural, therefore, in consequence of these, to equip the first separating devices of the new mill with woven wire or perforated plates. In the course of the development, however, these have not been exclusively retained. Today we can distinguish in all no fewer than four types of construction of partition walls or chambers:

1. With screening on external screens;
2. With screening on internal screens;
3. With separation on fixed annular slots or gratings;
4. With separation on adjustable annular slots.

*Translated from *Tonindustrie-Zeitung* 54:386-389, March 20, 1930.



Figs. 1, 2 and 3. Fellner & Ziegler compound mill of the older type construction.

Screening on External Screen

In Figs. 1-3 is shown a compartment mill of the old type with screening of the preliminary-ground material on slotted plates placed outside around the grinding shell. The preliminary-ground material passes through openings in the three-part wall *d* and reaches the cylindrical screen *e* which undertakes the separating of the coarse oversize from the fine particles. The former are returned by means of scoops *f* and the conduits *g* for another grinding in the preliminary chamber *b*, while the fine particles fall onto a mantle plate *h* provided with conveying strips and by means of lifting arms *i* and conduits *k* are led into the fine-grinding compartment.

As one sees, the separating proceeds in a quite complicated manner; fines and oversize must travel a long way till they have reached their goal, and the number of parts of which the apparatus is composed is great. The screens must be brushed often, particularly when not-quite-dry material is ground, and require constant attention. Nevertheless, this type of construction has persisted for many years up to today; a proof of the value of the compartment mill that it is not destroyed even by its own defects.

Somewhat unusual to our view seems the solution of the same problem by Allis-Chalmers, Milwaukee, Wis., U. S. A. Here, bent tubes are used both for returning the oversize and for delivering the fines into the fine-grinding chamber; these, with the one open end, dip out of masonry sumps, while the other open end extends into the grinding chamber. Strong wire screens serve for the screening. The entire apparatus is surrounded by a fixed housing which must be shut off dust-tight from the rotating mill shell and also from the masonry work.

Screening on Internal Screen

The first compartment mill with internal screening has already been described in various places (*V. D. I. Zeitschrift* 1920 page 475; C. Naske "Zerkleinerungsvorrichtungen und Mahlanlagen Ill. A. page 166), and can only be referred to here. This device shows the important characteristic of

mobility in the axial direction of the mill barrel, through which it is possible to alter the lengths of the grinding compartments at will and to bring them in proper relation to one another in simple fashion.

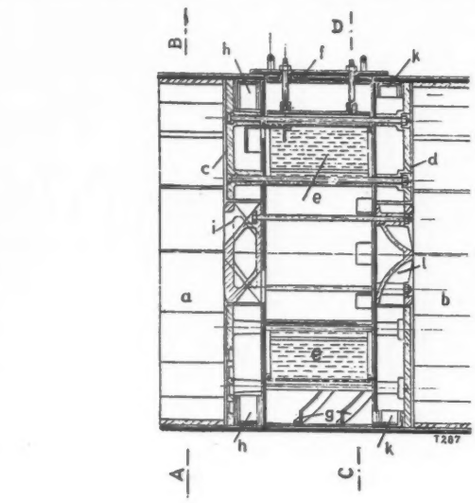
In Figs. 4 and 5 another construction of this type is presented, the details of which are apparent from the drawings without further comment. Particularly notable here is that the individual parts of the screen polygon *e* are conveniently available through the openings *f* and can easily be taken out. This not only diminishes the work in brushing and changing the somewhat damaged screens, but also proves itself particularly advantageous in putting a new mill in operation or in grinding a material not yet thoroughly known, enabling one, without too great a loss of time, to study the influence of different sorts of screen sets on the mill capacity, and to determine the most favorable width of mesh or size of slots.

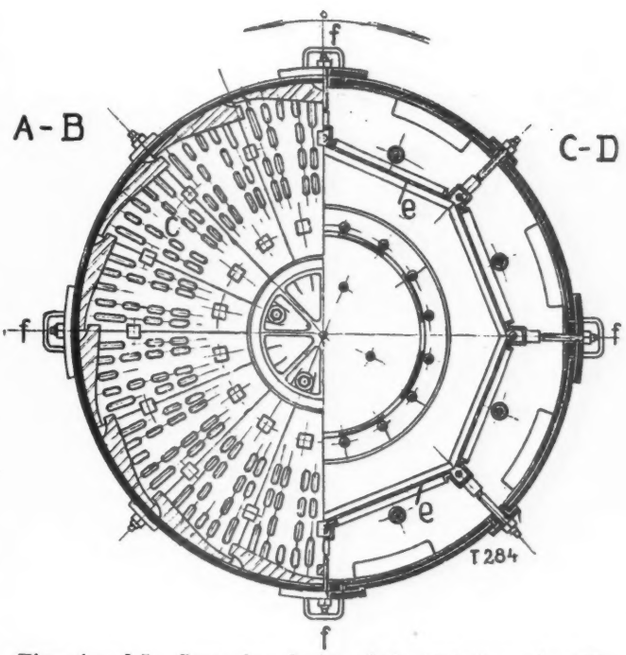
Separation on Fixed Annular Slots or Grates

A considerable variation from the employment of all kinds of woven-wire screens, perforated plates and the like was shown first by the "Rekord-Wall" illustrated in Fig. 6. The side *a* of this highly simple device turned toward the preliminary grinding compartment is composed of a number of individual rings arranged around a center opening, which form narrow slots which are so profiled that clogging is avoided. The side *b* turned toward the fine-grinding compartment, on the other hand, is solid up to a center opening. Between the two center openings is placed a "star" *c* in the form of a double cone provided with ribs, the steep portion of which lies on the preliminary, and flatter, part of the finish-grinding side. The ribs serve for the fastening of the scoops *e*, which are also connected with the two walls. The whole is held together by the outer shell *d* and is replaceable.

In operation, there passes through the annular fissures at the bottom a mixture of coarse and fines, the separation of which is so accomplished by means of the particular form of the scoops *e* that the fines pass over the flatter part of the double cone into the fine-grinding chamber; the coarse material on the other hand is carried back over the steep portion into the preliminary-grinding compartment to undergo a second reduction. In each revolution of the grinding mill there thus takes place a complete emptying of the intermediate chamber, and the material being ground always passes out of the preliminary grinding compartment, entirely unhindered, into an empty space.

For many reasons the annular slots must not be made too narrow; in spite of this their qualitative screening effect in combination with the scoops is good. Thus, investigation of a 2 by 11-meter mill showed that the material just before the Rekord wall had 50 per cent remaining on the 4900 mesh and 22 per cent on the 900 mesh per sq. cm. of screen, but that just behind the wall, only 38 per cent remained on the 4900-mesh and 9 per cent on the 900-mesh screen. Further grinding in the 7-meter fine-grinding compartment then produced the required fineness in this case for the powder (of rotary-kiln clinker), of 0 per cent on the 900-mesh and 6 per cent on the 4900-mesh screen.





Figs. 4 and 5. Screening device of the Polysius solo mill.

The center opening, together with the annular slots at the top, give a free cross section of such size that in the grinding of a not entirely dry material the vapors arising are effectively removed from the exhauster of the dust-collecting installation with which every compartment mill should be connected.

As a type, similar to the foregoing, of outstanding simplicity, is to be cited the replaceable separating wall of Fig. 7, the manner of functioning of which is easy to understand from the drawing and legends and needs no further explanation.

The sieve wall of the compound mill illustrated and described in *V. D. I. Zeitschrift*, 1929, page

1783, consists of exchangeable gratings in connection with a device for delivering the grit into the second compartment and a longitudinal conveyor for returning the oversize into the first compartment. This mill also can be well ventilated.

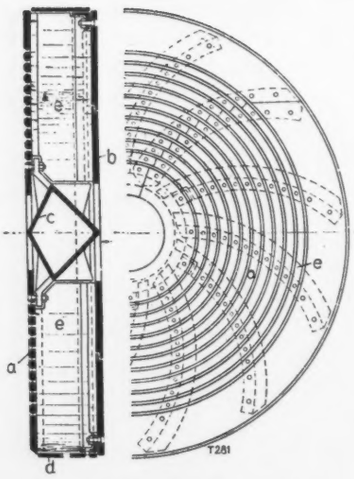


Fig. 6. Intermediate wall of Rekord compartment mill.

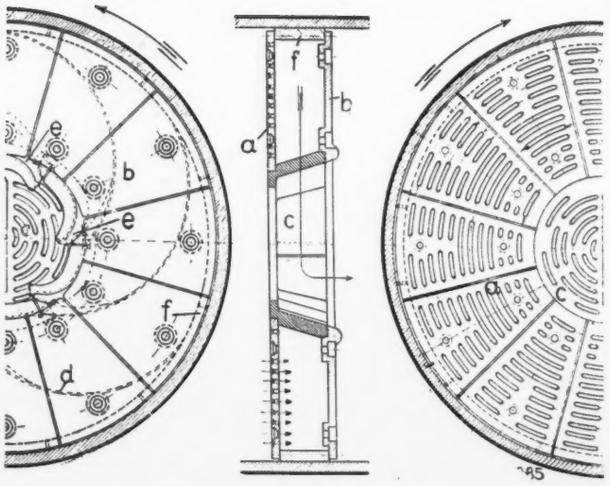


Fig. 7. Intermediate wall of Krupp compartment mill.

Separation on Adjustable Annular Slots

Changes in the nature of the material being ground or in the fineness requirements can be met by acting on the period of grinding through changing the quantity of feed. Greater feed causes a shorter period of grinding, other conditions being equal, and yields a coarser product; lighter feed, on the contrary, has a longer time of grinding and therefore a finer grinding results.

The lighter feed is disadvantageous since, in that case, the entire mill has to run empty in a greater or less degree, whereby the grinding elements and the lining are attacked harder than otherwise and rapid wear results.

The changing of the width of the slots formed by rings a-a_4 in Fig. 8 takes place by the moving in or out, during a brief interruption of operation, of the adjusting rings d^{1-5}, which are attached to the sheave c. The necessary slight axial movement of the latter is accomplished by means of the set-screw shaft g, so that if g is screwed in the cross section of the slots is cleared; if to the outside, the section is narrowed down. Noteworthy here is further the good possibility of airing.

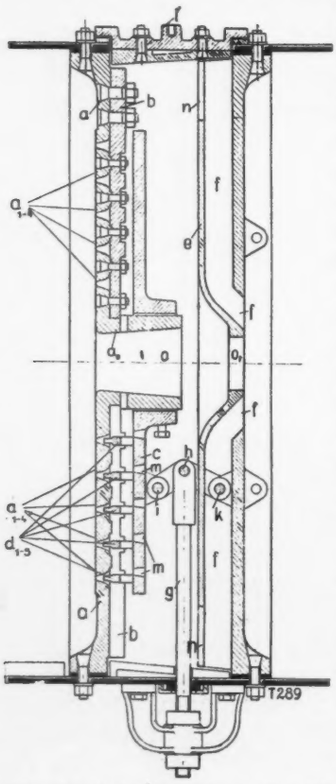


Fig. 8. Intermediate wall with adjustable annular slots.

In the separating wall shown in Fig. 9 the means for adjusting the cross section of passage consists of a sheave b whose perforation corresponds with that of the solid wall a, so that by a partial revolution of b, all slots of a are more or less covered. This simple mechanism can be conveniently handled and is secure in operation. On the other hand the possibilities of a de-aering seem less complete.

The foregoing types had in view the simple compartment mill in which only one separating wall is provided. In three-compartment mills it is the rule to arrange the first wall as a fixed or removable screening element; the fine-grinding chamber from the middle compartment, however, is usually

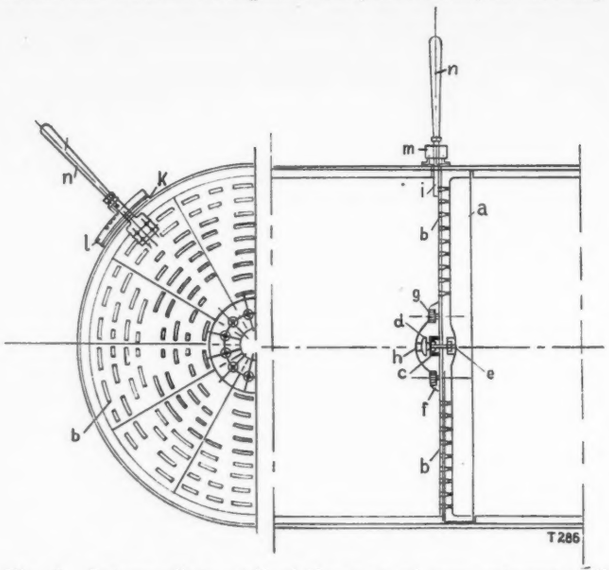
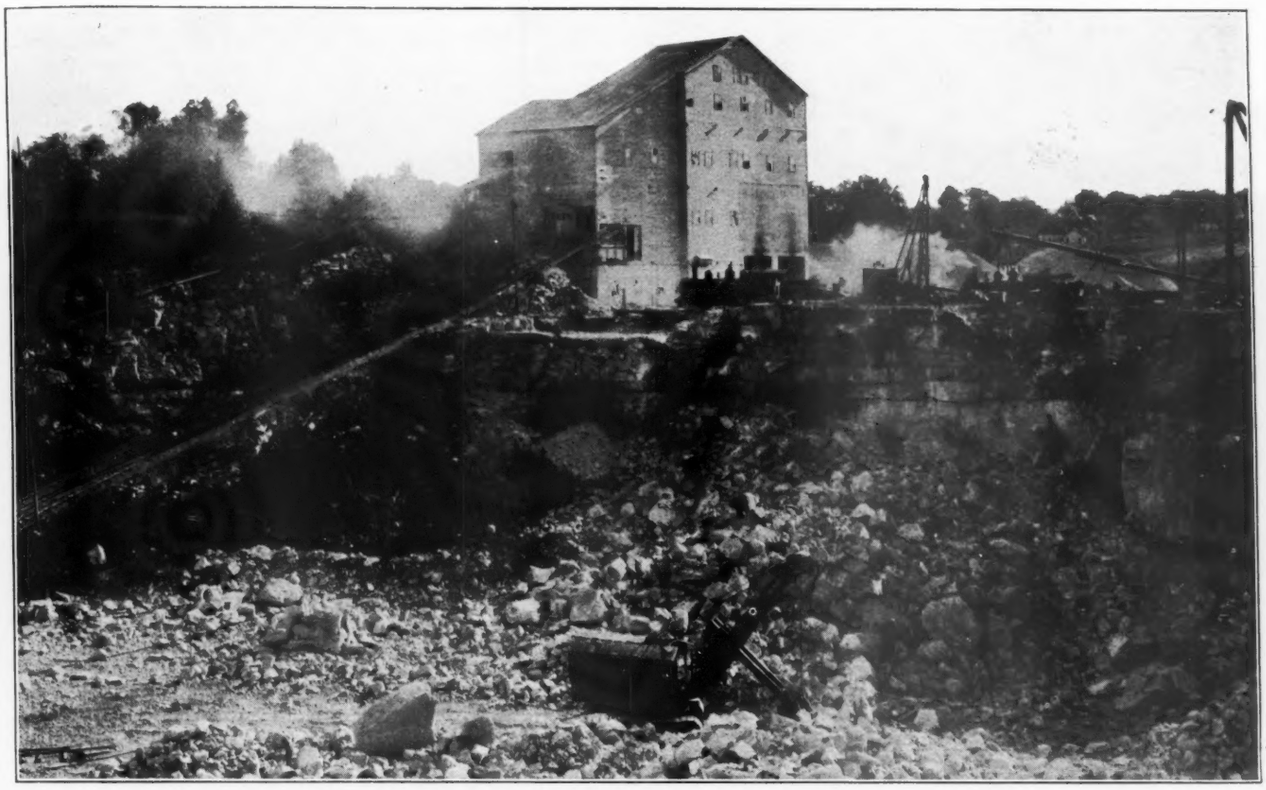


Fig. 9. Intermediate wall of Kampnagel compartment mill.

divided only by a simple grating wall which, for the purpose, is also made removable. However, one also finds three-compartment mills in which the first wall is formed as a simple grating wall and the second as a screening wall; this arrangement is especially appropriate when the screening wall has adjustable slots (Fig. 8 and 9). Finally, cases are known where both walls are built as screening units, but this seems to be advisable only for constructions according to Fig. 9, since for the separation of different sizes in the middle and fine-grinding compartments, a simple grating wall suffices.

Crushed-Stone Plant Increases Output of Agstone to Supply Demand



Plant from far side of quarry with car of stone going up incline at left. Well drill and derrick for rip rap at right.

Pioneer Operator in Southern Illinois Keeps Large Stocks Constantly on Hand

THE Anna Stone Co., of Anna, Ill., which conducts one of the oldest crushed-stone operations in southern Illinois, recently made some changes in its plant and quarry. These changes increased the output of agstone, for which the demand exceeds the supply, and made possible more economical production of crushed stone. The company has been operating for over 25 years but the present plant was built in 1925.

The property of 63 acres owned by the company is located inside of the city limits of Anna about ¾ mile from the center of town. The deposit has been drilled to a depth of 500 ft. without running out of good limestone. The stone is free from cracks and clay and contains no flint or sandstone.

The overburden averages about 20 ft. in depth and is removed by an O. K. Clutch & Machinery Co. 2-cu.yd. cable-drag scraper operated by an 80-hp. electric hoist of the same make. In some places the surface of the rock has shallow crevices.

Supt. G. E. Johnson alongside new gasoline crane.

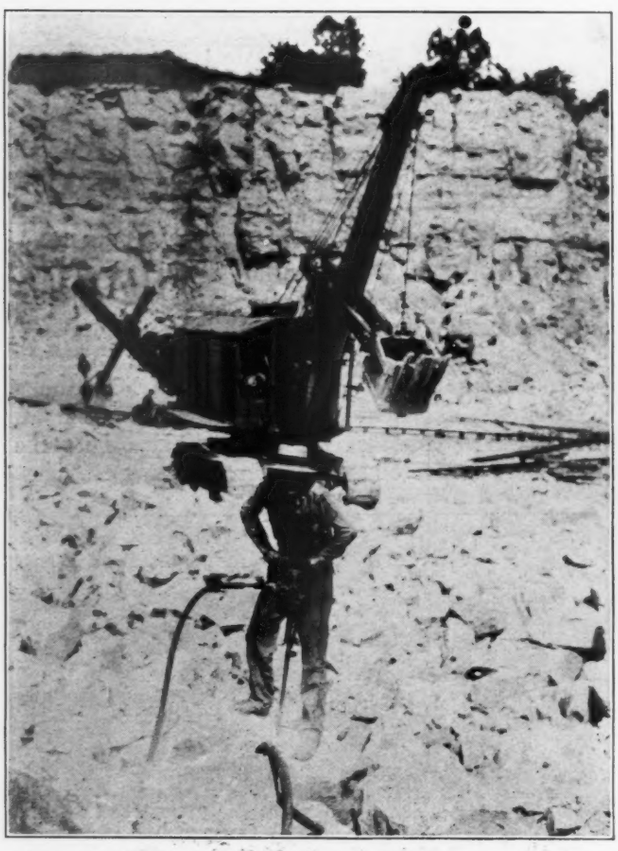
Main plant building with office at left.

Stripping with 2-cu. yd. drag scraper driven by electric hoist.

The overburden is removed from these by an Osgood gasoline crane equipped with a ¾-cu.yd. clamshell bucket. The drag scraper has been in operation only a few months and is handling the overburden in a very satisfactory manner.

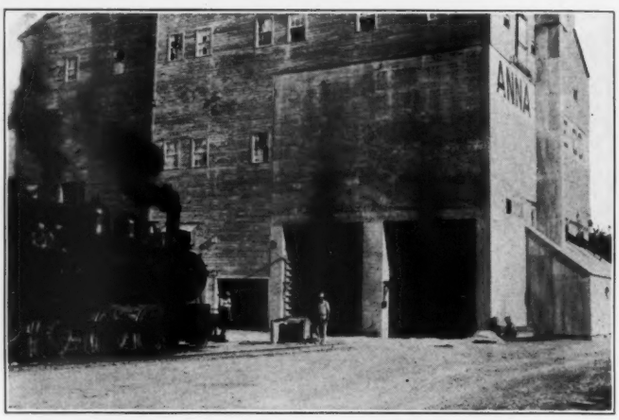
The quarry face is now about 80 ft. high. Drilling of blast holes is done by a Sanderson Cyclone electric well drill. Single-row electrically-detonated bank shots are made using Illinois Gold Medal 40 and 60 per cent dynamite. Secondary drilling is done with Gardner-Denver jackhammers. A large shot was recently made which brought down several months' supply of stone.

The stone is loaded by a 50 B Bucyrus 2-cu.yd. electric shovel. These load into Vulcan 5-ton all-steel end-dump cars which are hauled to the foot of the incline to the plant by three 2-ton Whitcomb gasoline locomotives. The electric shovels have been operating satisfactorily for a number of years and were among the first to be put into operation.



Secondary drilling with jackhammer in quarry. Two electric shovels in background.

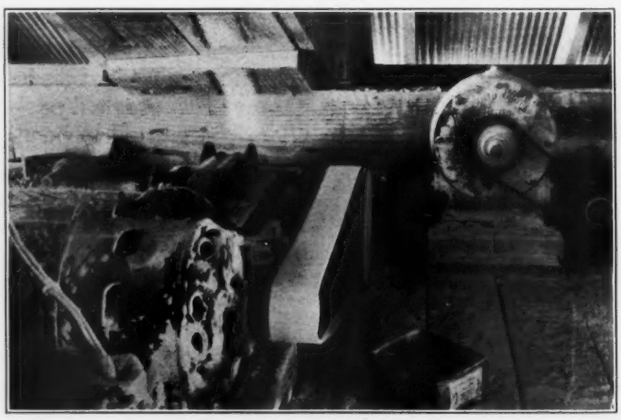
The cars are hauled up the incline by a balanced-type skip operated by an Ottumwa Iron Works single-drum hoist driven by a 100-hp. Fairbanks-Morse electric motor. The cars dump, at a height of about 100 ft. above the quarry floor, into the



Close-up of loading tunnels under bins with locomotive and gasoline car puller in foreground.

Allis-Chalmers Gates No. 12 primary crusher which is belt-driven by a 125-hp. General Electric motor. The primary crusher discharges to a bucket elevator on 120-ft. centers which feeds a 5-ft. by 24-ft. revolving screen at the top of the plant. This is ordinarily used for the production of sizes ranging from ¼-in. to 2¼-in.

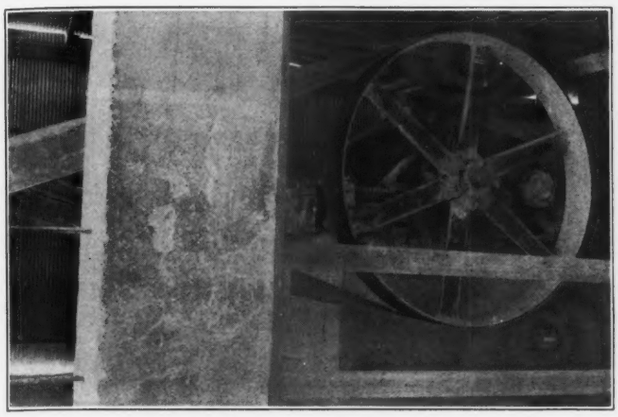
The rejects from the large revolving screen are carried by a short belt conveyor to an Allis-Chalmers McCully No. 10 crusher for reduction. This feeds to a 3-ft. by 12-ft. revolving screen which takes out material from 2¼-in. down. This goes to a second bucket elevator. The rejects from the second screen go to a 4-ft. Symons cone crusher



Roll-mill feeder driven through speed reducer and variable speed drive.

which feeds to the same elevator. Both of these crushers are belt-driven by the same Westinghouse 200-hp. motor.

This bucket elevator feeds a Niagara double-deck, 4-ft. by 8-ft. vibrating screen. The throughs from the bottom deck drop to a Niagara double-deck 3-ft. by 6-ft. vibrating screen which produces two sizes and dust. A similar screen under the



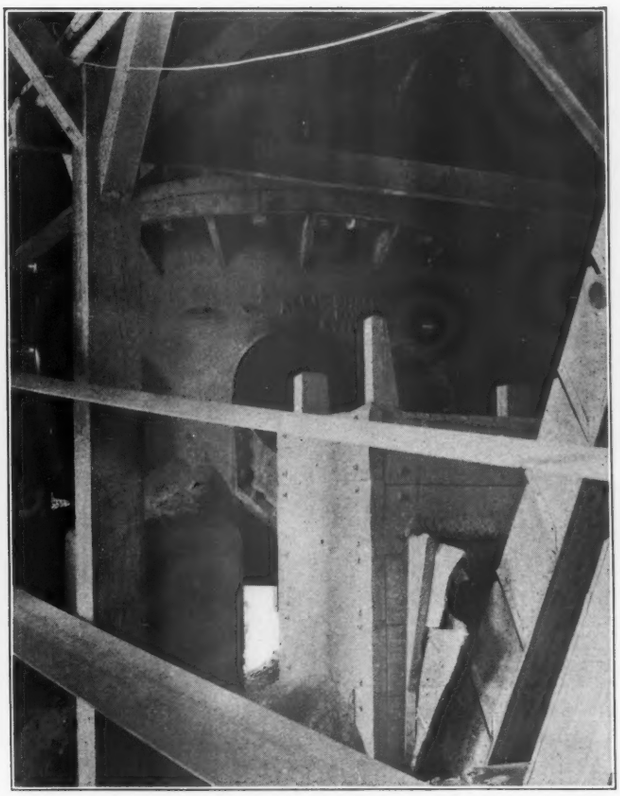
Double-roll crusher used for the production of agstone.

main revolving screen is used for the same purpose. Both are driven through Texrope drives. All sizes produced are chuted into the 1,500-ton capacity concrete bin which has ten compartments in two rows of five each.

A small addition was recently built to the plant to allow a greater output of agricultural limestone for which there is an increasing demand. One of the concrete storage bins feeds by gravity to a 10-in. belt feeder driven by a 1-hp. motor through a

One of the double-deck vibrating screens.

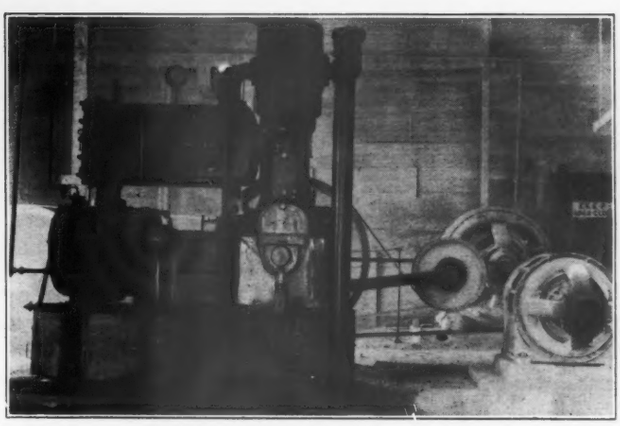
Reeves variable speed pulley and a Winfield H. Smith worm-gear speed reducer. The feeder discharges to an Allis-Chalmers double-roll mill which is belt-driven by a 50-hp. motor. The roll discharges to a bucket elevator feeding a Universal single-deck 3-ft. by 8-ft. vibrating screen. The rejects go back to the original bin while the fines go to another bin for agricultural limestone and asphalt filler.



Primary gyratory crusher with bucket elevator at right.

A considerable amount of rip-rap is also produced at the quarry and sold for use in building roads, bridges, spillways, etc. This stone is loaded by hand in the quarry into a 3-cu.yd. skip bucket and lifted to cars at the top of the face by an 80-ft. boom timber stiff-leg derrick. The derrick is operated by an American Hoist & Derrick Co. hoist driven by a 25-hp. motor. About 200 skips of rip-rap can be loaded in a day in this manner. Cars are spotted here and under the rock storage bins by a National Hoisting Engine Co. gasoline hoist.

The company has a policy of always keeping a sufficient amount of all sizes of material on hand to enable any unusually large orders to be filled without delay. In addition to the 1,500-ton bin



Compressor furnishing air for jackhammers. Air filter at lower left.

Quarry view from top of plant showing results of recent quarry blast. Well drill at left, shovels at right.

storage at least 20,000 tons are stored in stockpiles. This amount, of course, will vary considerably but a period of peak demand is generally followed by a slack period which allows the storage to be again built up. A new Osgood Commander gasoline crane with a ¾-cu.yd. Owen clamshell bucket is used to rehandle the stockpiled material. The Osgood crane now being used for stripping overburden is also pressed into this service when demand requires.

The plant is not located near a railroad but has its own 1½-mile Anna-Jonesboro Ry. connecting it with the Illinois Central Ry. This short line also serves several other industries. All switching and hauling is done by an American 70-ton steam locomotive. All car shipments are weighed on a 125-ton capacity Fairbanks track scale and truckloads on a smaller scale of the same make. The present capacity of the plant is 1,500 tons per day including 500 tons of dust.

Air for secondary drilling is furnished by a Sullivan Class WJ3, size 16, 9¾-in. by 10-in. air compressor which is belt-driven by a 125-hp. General Electric motor and is fitted with a Reed air filter. United States Rubber Co. drive, elevator, and conveyor belts and Leschen cable are used throughout the entire operation.

The office of the Anna Stone Co. is at the plant. Officers are: Bernard Vellenga, president; Fred Person, vice-president; G. A. Dahlberg, secretary; and John Benson, treasurer; all of Chicago, Ill. Gustaf E. Johnson is superintendent.

Study Burning Characteristics of Various Solid Fuels

Interest in smokeless fuels has centered attention on the relative burning characteristics of cokes made by the various high-and-low temperature processes. Recently the Physical Chemistry Section of the Pittsburgh Experiment Station, United States Bureau of Mines, published data on the time of burning of small particles of coal, semi-coke, beehive coke, and charcoal under controllable conditions of furnace temperature, particle size and oxygen concentration. Work along this line is being continued on somewhat larger particles and on still other fuels.

Through the use of fuel particles weighing 4 milligrams it has been possible to follow the temperature of the particle throughout its burning. The maximum temperature of an individual particle burning in an excess of air at 800 deg. C. is, of course, much below the temperatures obtainable in a fuel bed.

The interesting part of the temperature curve of the burning, however, is the form the curve takes under different conditions. When the air temperature is 800 deg. C. the rate of rise of the particle temperature above the air temperature is so slow and variable that it is nearly impossible to assign a definite point as the "start" of ignition or active burning. Likewise, the point of completion of burning is often prolonged. With air at 1000 deg. C. the rate of rise and decline of temperature is very rapid. These effects vary with the nature of the fuel, being most pronounced for a material like electrode carbon. Therefore, strict comparisons of the burning times of many fuels by this method at the lower air temperatures are not possible.

Insulation of Cement Kilns Results in Increased Burning Efficiency

Fuel Conservation and Longer Life of Kiln Shell Other Paramount Advantages

By G. E. GRIMSHAW
Special Engineer, Johns-Manville Corp.

THERE is no disputing the fact that the heat dissipated by conduction and radiation from an uninsulated rotary cement kiln is a very considerable figure. Only within the past few years has it been possible effectively to conserve a large percentage of this heat by the use of insulation.

There is no apparatus operating under temperature conditions similar to those encountered in the rotary cement kiln in which insulation is subjected to such severe service. For, in addition to high temperature, there is rotation, vibration, abrasion, moisture, expansion and contraction of the firebrick lining and the continued impact of the heavy mass of clinker throughout the kiln. What is more, a shut-down due to a hot spot means a loss of about $5,000 every 24 hours per kiln. For these reasons, the insulating of rotary cement kilns involves so great an element of risk not only to the cement plants, but to the insulation manufacturers as well, that this problem of rotary kiln insulation has only recently been solved.

In the spring of 1924, a special block insulation was subjected to its first severe trial in a cement kiln. Since then this kiln has operated almost continuously with only the necessary periodical shut-downs for renewing fire brick at the hot zone where insulation is not installed. On such occasions, an inspection revealed the insulating material to be in perfect condition.

Further evidence of the success of such installations is that over 30 kilns have been insulated similar to the specifications followed in 1924 without a single failure.

The advantages resulting from the insulating of rotary cement kilns can be briefly summarized as follows:

Fuel Conservation. The heat lost by radiation from a 10-ft. by 150-ft. uninsulated kiln, average temperature 1,750 deg. F., is equivalent to approximately 5,000,000 B.t.u. per hour. Using pulverized coal with available heat of 10,000 B.t.u. per pound and coal costing $5 per ton, the annual loss equals $9,000. By insulating the intermediate portion of the kiln for a distance of 75 ft., it is possible to save about 40 per cent of this loss or $3,600 per year.

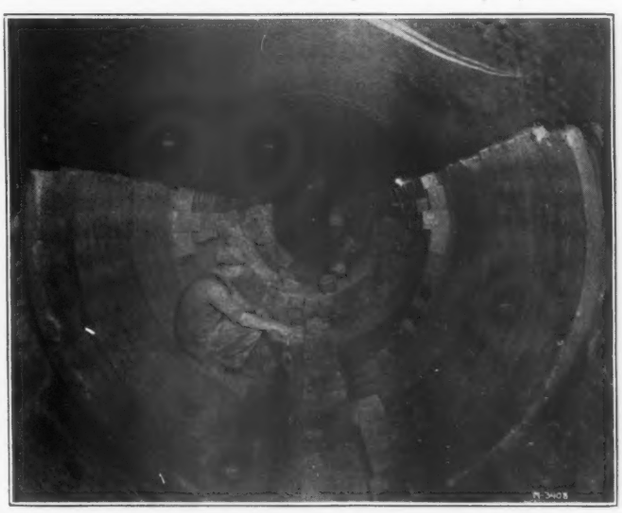
Increased Temperature of Flue Gases. In plants where waste-heat boilers are used, insulation in the kilns and waste-heat flues will increase the temperature of the gases 150 deg. to 250 deg. F. Where waste-heat boilers are not installed, it is possible through insulation to save 30 lb. to 60 lb. of coal per ton of clinker.

More Uniform Distribution of Heat. There is considerably less variation in temperatures throughout the length of the insulated kiln, and the kiln is less susceptible to outside temperature changes. A wind velocity of 15 miles per hour increases radiation loss in an uninsulated kiln approximately 11 per cent whereas, in the case of the insulated kiln, it is only 5 per cent.

Protection and Longer Life of Kiln Shell. Insulating materially reduces the temperature on the kiln shell, overcoming, to a large degree, the stress and strain on the steel plates, the loosening of rivets and the bulges that sometimes occur in the unprotected shell. A test on rotary kilns showed an average inside temperature in the intermediate zone of 1,550 deg. F. in an uninsulated kiln and 1,750 deg. F. in an insulated kiln, while the average external-surface temperatures were 640 deg. and 280 deg. F. respectively.

This reduced surface temperature naturally makes better working conditions about the equipment, increasing the comfort and efficiency of employees.

It is estimated that the domestic production of Portland cement in 1929 amounted to approximately 170,000,000 bbl. If it is assumed that all the fuel used in manufacturing was coal and using the figure of 120 lb. of coal per bbl. of cement, the total coal consumption would amount to over ten million tons.



Insulation laid between shell and kiln blocks.

Insulating upper half of kiln using arch forms.

A conservative estimate of the saving accomplished by insulating a kiln is 10 per cent of the coal consumption. By insulating 25 per cent of all the kilns in the country, the saving to the industry would run approximately 250,000 tons of coal per year, well over a million dollars on the basis of present coal costs.

The successful insulation of a rotary kiln depends largely on the use of a standard specification for the installation of the insulation, refractory cement, and fire brick lining to prevent circumferential slippage of the lining and to localize longitudinal movement.

In practice, the insulation is placed between the outer steel shell of a kiln and the kiln blocks used for lining. The lower portion—usually to perhaps one foot above the center along the sides—is first insulated and lined for about 20 ft. longitudinally of the kiln.

The upper portion may be completed by carefully wedging the lower lining and then rotating the kiln 180 deg., or by the use of wooden forms as in ordinary arch work.

Production of Non-Metallic Minerals in Canada Shows Big Increase

A preliminary report on the mineral production of Canada during the calendar year 1929, published recently by the Dominion Bureau of Statistics, states that, for the fourth year in succession, the mining industry in Canada reached a new high record of production. Gains of $2,600,000 in the value of cement, $3,690,000 in other structural materials such as brick, lime, stone, sand and gravel, and a rise of $1,930,000 in the value of asbestos were high lights in Canada's greatest mining year when the total output was valued at $307,146,494 or 11.69 per cent more than the valuation of the previous year's production. Lower values in a few items including gypsum, left the net gain for the year at $32,157,007.

New records were established in 1929 in the output of asbestos, cement, lime, salt and stone.

Non-metallic minerals, including asbestos, feldspar, gypsum, mica, quartz, salt, talc and soapstone had a value of $20,698,481, compared with $18,826,692 in 1928. Gains made in this group were 9.9 per cent, or $1,871,789. Structural materials including brick, tile, cement, limestone and sand and gravel were valued at $56,031,846 compared with $49,737,181 in 1928, and showed a gain of 12.65 per cent, or $6,294,665.

Fair Comparisons Are Essential in Conducting Safety Contests

Either a comparison of the number of accidents occurring in the contesting units, or the number of days the contestants have been able to work without an accident, is considered a simple basis for safety competition.

To make allowance for variations in the exposure of competing units, an accident frequency rate—that is, the number of lost-time accidents per 1,000,000 man hours worked—is often used. A similar rate is, at times, expressed in terms of production units; or example, the number of accidents per 1,000 car miles operated, or per 1,000 tons of material quarried.

In some cases, allowance is also made for the relative seriousness of accidents by basing the contest upon severity rates which are computed by relating the total number of days lost in a given unit to the number of 1,000-man-hours worked.

To provide for differences in the exposure of contesting groups, contests are frequently based upon the percentage of reduction in the number of accidents, or in the frequency or severity rates made during the contest as compared with records for a preceding period.

Production of Masonry, Natural and Puzzolan Cements in 1929

Statistics of hydraulic cements, other than Portland cement in 1929, which include masonry, natural, and puzzolan cements, as compiled by the United States Bureau of Mines, Department of Commerce, show a production of 2,209,465 bbl., which represents a decrease of 0.04 per cent compared with 1928. There were shipped from mills in 1929, 2,159,130 bbl. of these cements, valued at $2,950,717, a decrease of nearly 2.5 per cent in quantity, and an increase of 1.4 per cent in gross value compared with 1928. Stocks at the mills increased and were more than 36.6 per cent higher at the end of 1929 than at the end of 1928.

These statistics represent the output of 11 plants located as follows: One each in Alabama, Illinois, Indiana, Kansas, Kentucky, Ohio, and Pennsylvania; and two each in Minnesota and New York. The figures for 1929 include the output of a new plant in New York, which began operating toward the end of 1929, superseding an establishment that was active in 1928, but reported idle and out of business in 1929.

MEN OF THE INDUSTRY

The portrait printed on this page in each number of PIT AND QUARRY is selected without significance as to current events or the position of the individual in the industry.

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R. E. TREMOUREUX

Director and Consulting Engineer,
United States Lime Products Corp.
Golden Gate-Atlas Materials Co.
San Francisco, Cal.

Personal Mention

Raymond Wilson, who has been associate chemist in the research laboratory of the Portland Cement Association, has been appointed conservation engineer of the association. Mr. Wilson has been in the employ of the association since 1921. He succeeds **H. W. Newton**, who resigned several months ago to join the Symons crusher sales division of the Nordberg Manufacturing Co., Milwaukee, Wis.

Harry Ellsworth Clifford, since 1909 Gordon McKay professor of electrical engineering, has been chosen dean of the Harvard engineering school to succeed the late Hector James Hughes.

Frank Purse, of Tacoma, Wash., an engineer and former member of the civil service commission of that city, has been appointed supervisor of public utilities of the state of Washington, a post that has been vacant since last August, when **C. Rea Moore** resigned.

N. Altiery, consulting engineer, of Philadelphia, Pa., has been elected vice-president and chief engineer of the DePaul Construction Co., Inc., of Philadelphia. Mr. Altiery has been connected with various public works, state highways, railroads, bridges and building projects throughout the eastern, southern and central states.

Charles Felton Scott, professor of engineering at Yale University, was awarded the Lamme medal at the convention of the Society for the Promotion of Engineering Education, held in Montreal June 25-27. The medal is awarded by the society each year to a technical instructor for accomplishment in technical training or actual advancement of the art of technical training.

Russell Woodburn, recently with the Erie Railroad as engineer and inspector on construction projects, stationed at Wellsville and Hornell, N. Y., is now connected with the Missouri state highway commission, where he is engaged in locating the state system of "farm to market" highways.

Fred Coppock, president of the American Aggregates Corp., Greenville, O., and a member of the board of directors of the National Sand & Gravel Association, has been appointed a member of the natural resources committee of the United States Chamber of Commerce.

William A. Van Duzer, of Harrisburg, Pa., president of the American Road Builders' Association, has been designated by the state department at Washington, D. C., as a representative of the United States on the Permanent Commission of the International Association of Road Congresses, according to announcement from the Department of Agriculture.

J. B. John

J. B. John, chairman of the committee on accident prevention of the Portland Cement Association, observed his birthday anniversary on July 11. His many associates who have appreciated his splendid work in connection with accident prevention in the cement industry sent him many kind words of congratulation by mail and telegraph. Mr. John is president and general manager of the Medusa Portland Cement Co., Cleveland, Ohio.

Oliver A. Dibble, for 15 years chief chemist of the Aetna Portland Cement Co. plants, was recently appointed general superintendent of both of the company's plants, located at Fenton and Bay City, Mich.

E. H. McEuen, prominent in the lime industry in California and one of the contributors to the 1930 edition of PIT AND QUARRY HANDBOOK and Directory, has assumed control of the Abramson-Bode lime quarry and properties near Fresno, Cal. The industry employs 80 men. Mr. McEuen has also established a sand and gravel plant near the lime quarry.

Dr. W. B. House of Saugatuck, Mich., has sold his limestone deposits on Drummond Island, located in Lake Huron near the international boundary, to the Thomas L. Durochee Wrecking Co. of Detour, Mich. The latter concern plans to open a stone quarry in the near future.

Charles E. Grubb, former county engineer of New Castle county, Del., has been named executive engineer of the American Road Builders' Association's county highway officials' division. The division is increasing its efforts toward efficient financing, planning and administration of highways in all counties. A summary of county expenditures for construction and maintenance includes figures just received from 1,066 counties, slightly more than one-third of the total number and shows an interesting increase of expenditures for this year over those for 1929. The counties reporting, which is a fair estimate of the counties which have well-organized county highway commissions contemplate expenditures for highway and bridge construction in 1930 of $195,157,725 as compared with an expenditure of $177,059,754 in 1929. For maintenance, the 1,066 counties will expend $98,412,832 this year, as against $94,249,810 last year.

H. V. Chase has been named assistant director of operations, explosives department, Hercules Powder Co., according to an announcement by **C. A. Bigelow**, general manager of the department. For the past two years Mr. Chase has been superintendent of the Kenvil, N. J., explosives plant, and previous to this he was superintendent of the Bessemer, Ala., and Bacchus, Utah, plants of the company. In his new position Mr. Chase will assist **William C. Hunt** in directing the operations of the eleven Hercules explosives plants in various parts of the country. Succeeding Mr. Chase at Kenvil, **W. S. Brimijoin** has been appointed superintendent of the Kenvil plant. Formerly superintendent of the Joplin, Mo., and Bessemer, Ala., plants, Mr. Brimijoin has been assistant superintendent at Kenvil since 1928. The Kenvil plant is the largest in point of capacity of the explosives plants of the Hercules Powder Company.

Obituary

Harry C. McLaughlin, a contractor, of Indianapolis, Ind., died recently. Mr. McLaughlin was employed in the construction of the Panama Canal and for that service received a medal from President Roosevelt.

Richard Washington Alexander, vice-president of the Poole Engineering & Machinery Co., of Baltimore, died in a Baltimore hospital on June 19 of pneumonia. Mr. Alexander was 55 years of age at the time of his death.

William M. Lee, district engineer of the Iowa highway department, died recently in Cedar Rapids, Iowa. Mr. Lee, who was a graduate of Iowa State University, had been district engineer for the department at Cedar Rapids for twelve years. He was 42 years old.

Coming Events

July 16, 1930. New York, N. Y. Meeting for clay producers at the New York Athletic Club. W. J. Parker, Commissioner, 7 East 44th St., New York, N. Y.

July 29, 1930. Austin, Tex. Annual meeting, Texas Sand and Gravel Producers' Assn. Austin Hotel. W. W. Carson, executive engineer, Littlefield Bldg., Austin, Tex.

Sept. 9, 1930. Seattle, Wash. Portland Cement Association regional safety meeting, at New Washington Hotel. A. J. R. Curtis secretary, 33 W. Grand Ave., Chicago, Ill.

Sept. 9, 1930. Chicago, Ill. Regular meeting, Gypsum Assn., Bismarck Hotel. Henry J. Schweim, executive secretary, 211 W. Wacker Drive, Chicago, Ill.

Sept. 16, 1930. San Francisco, Cal. Portland Cement Association regional safety meeting, at St. Francis Hotel. A. J. R. Curtis, secretary, 33 W. Grand Ave., Chicago, Ill.

Sept. 23, 1930. Ogden, Utah. Portland Cement Association regional safety meeting. Hotel Bigelow. A. J. R. Curtis, secretary, 33 W. Grand Ave., Chicago, Ill.

Sept. 29-Oct. 3, 1930, Pittsburgh, Pa. Annual congress and exposition. National Safety Council, William Penn Hotel. W. H. Cameron, managing director, 20 N. Wacker Drive, Chicago.

October 6-10, 1930, Washington, D. C. Sixth International Road Congress at invitation of the United States Government. Thos. H. McDonald, chief of the United States Bureau of Public Roads, secretary-general of the American Organizing Commission. International Road Exposition in charge of the American Road Builders' Association. Charles M. Upham, engineer - director, National Press Bldg., Washington, D. C.

Dec. 1-5, 1930. Memphis, Tenn. Ninth Annual Asphalt Paving Conference of the Asphalt Institute. Meeting of the Association of Asphalt Paving Technologists in conjunction.

Dec. 1-6, 1930. New York, N. Y. National Power Show, Grand Central Palace.

Jan. 27-29, 1931. St. Louis, Mo. Annual convention National Sand & Gravel Assn., Hotel Jefferson. V. P. Ahearn, executive secretary, Washington, D. C.

Produces 400 Cu. Yd. of Aggregates Daily with Portable Equipment

Richard A. Walsh operates a sand-and-gravel pit at Providence, R. I. The bank material averages approximately 65 per cent sand and 35 per cent gravel. He produces for delivery 300 to 400 cu. yd. of screened aggregates per 8-hr. day with portable equipment only. The excavation, screening and loading into trucks are accomplished by the use of a Barber-Greene bucket loader which is equipped with a Deister Concentrator Co. Leahy screen.

Power for the operation of this compact machine is provided by a gasoline engine, integrally mounted.

Portable plant and trucks operated by Richard A. Walsh at Providence, R. I.

One operator and a helper compose the crew. The average consumption of gasoline per shift is 20 gal. and of lubricants, 2 qt.

Two trucks are usually loaded simultaneously, one with fine material, the other with coarse. When using a screen of ½-in. mesh, the separation gives 1 ton of gravel to 1½ tons of sand. Five-ton Mack and White trucks are employed. When using a screen of ¾-in. mesh, one truckload of gravel is produced for three truckloads of so-called sand. When simply preparing materials for stockpiling, three trucks are used and the daily production is more than 600 cu. yd.

When Mr. Walsh had used this machine a little more than one month, he estimated that it had returned to him between 55 and 60 per cent on his investment of $5,600. He figures that his operating costs for a season of 250 days will average 5.45 cents per cu. yd.

Merged Foundries Name Pack Chairman of Board

Albert Pack, formerly chairman of the board of the Hubbard Steel Foundry Co., East Chicago, Ind., has been elected chairman of the board of the newly formed Continental Roll & Steel Foundry Co., which has resulted from the consolidation of the Hubbard Steel Foundry Co., the Duquesne Steel Foundry Co., Pittsburgh, and the Wheeling Mold & Foundry Co., Wheeling, W. Va. Other officers elected are: J. T. Osler, formerly president of the Hubbard Steel Foundry Co., president; Donald C. Bakewell, formerly president of Duquesne Steel Foundry Co., vice-president; Herbert E. Field, formerly president of Wheeling Mold & Foundry Co., vice-president; William E. Trautman, formerly vice-president, Duquesne Steel Foundry Co., vice-president; W. H. Seaman, formerly vice-president of Hubbard Steel Foundry Co., vice-president, and D. R. Wahlberg, secretary-treasurer.

The directorate includes Harold Beacom, of Winston, Strawn & Shaw; D. A. Burt, chairman of the executive committee, Wheeling Mold & Foundry Co.; Andrew M. Scott, president of Cochran, Scott & Co., Chicago; J. J. Shinners, vice-president, H. M. Byllesby & Co., and Howard Whitehouse, vice-president, Continental Illinois Co.

Smith-Putnam Firms in New Chicago Offices

Announcement has been made of the removal of the offices of the Leathem D. Smith Dock Co., Maritime Engineering Corp., and Leathem Smith-Putnam Navigation Co. to 20 North Wacker Drive, Chicago. Principal officers of the above concerns are Leathem D. Smith and Major Rufus W. Putnam.

Interesting Comments by Readers

The letters reproduced below present the opinions of their writers and PIT AND QUARRY *assumes no responsibility for the accuracy or completeness of any statement they contain. They are published because they express views—constructive criticism, practical suggestions, illuminating comment—or problems that interest a considerable number of* PIT AND QUARRY *readers.*

LET'S GET BUSY

To the Editor:

Frankly, times haven't been any too good, and like Mr. Micawber, we have been largely sitting around "waiting for something to turn up." We've been fed up on the truism, "business depression is a state of mind." This has been drilled into us by the current press, and by our political and financial advisers, local and otherwise.

Nevertheless, there is no use trying to deceive ourselves. Call our troubles what you may—over-speculation, prohibition, tariff agitation or over-production—we just have a suspicion that they are the culmination of a series of idiocies, overdue and richly earned by diligent departure from lines of good sense.

Personally, we are taking advantage of this slack period to spruce up generally around our establishment. Nobody has been discharged, nobody's salary has been cut, and the payment of bills has not been unduly delayed. Our employees have been imbued with the spirit of giving the best service possible, and the public has never been better or more promptly served.

We are also doing a little extra advertising, giving out all the work we can to other concerns, and making a few extra calls on our friends and clients, not to talk "hard times," but just to shake hands warmly and cheerily say, "Howdy?" While we believe careful consideration should be given to major expenditures, we do not believe it is a time for penuriousness or narrowness in thought or act; in fact, liberal, sound-thinking may be good for us, for the world is moving pretty fast—"we are not the only ducks" in the national or industrial puddle—we don't want to be side-tracked over night.

We may be getting a little deeper in the hole financially, but the hole is getting smaller all the time, and if we maintain our poise the hole will soon be closed altogether, and business resumed under better conditions than for years.

Large concerns and public utilities employing thousands should remember they have the same responsibility regarding the welfare of individual employees as the little fellow, the same responsibility for keeping the wheels of commerce moving, and they have no more license for discharging a lot of people who have faithfully served through "good times" than have the small concerns. In fact, it is more incumbent upon "big business" to do its full share in maintaining the employment balance.

Don't let's wait around any longer for some great political stunt to be pulled off or spectacular financial movement to scintillate on the business horizon. Let's get busy, each putting his own house in order, thus showing confidence in ourselves and the future, and we will soon forget that business has been out of tune. By and by in years to come we or our successors will be called upon to meet like periods of readjustment, for economic "history does repeat itself."

SMITH-EMERY CO.
Los Angeles, Cal.

EXPLOSIVE HAZARDS

To the Editor:

An article on page 73 of the June 18 issue of PIT AND QUARRY, by L. B. Reifsneider, might possibly give a wrong impression to the users of high explosives in quarries. While it is true that different manufacturers of high explosives have different formulas, yet the ingredients used in any one type of explosive are almost exactly the same, and mixing explosives of different makes could not conceivably produce any chemical reaction which would be likely to cause an accident, provided, of course, that the explosives are of the standard types in which nitroglycerin is the essential ingredient, as in the case of straight dynamite, ammonia dynamite and gelatin dynamite.

Unbalancing the formula in explosives parlance means upsetting the relation between oxygen-bearing ingredients and carbonaceous material in the explosive, and has no effect whatever on the sensitiveness of the explosive. Quarry gelatin, for example, is purposely made on an unbalanced formula because this gives slightly greater strength, and in open work fumes are of no moment.

Friction or impact is responsible for all the quarry disasters laid to explosives of which we have any record. This friction may be caused by too great energy in compacting the explosive in the hole by means of a tamping rod or dolly, by friction between loose rocks in a ravelly bore hole, or even by friction between hobnails on workmen's shoes and the top of the quarry where the explosive is carelessly spilled around the hole. Friction between the rope used for measuring the height of the powder column and the side of the hole has caused at least two disasters in cases where explosives of a dusty nature were used. . . . . .

About the only real hazard conceivable in mixing the products of different manufacturers of standard make is in the case of electric detonators. The sensitiveness of these does vary with the make and it is possible that the more sensitive electric blasting caps would fire and those of a make less sensitive would miss, and a missed charge is always a disagreeable, and sometimes dangerous, condition.

E. I. DU PONT DE NEMOURS & Co.
Arthur La Motte,
Manager, Technical Section.
Wilmington, Dela.

New Corporations

Brooklyn Sand & Gravel Co., Independence, O. Leon B. Ehman, president; Dominec De Santo, secretary-treasurer. 250 shares n. p. v.

Louisiana Shell & Gravel Co., Inc., Dunbar, La. (P. O., Darrington, Miss.)

Jamaica Sand & Gravel Concrete Corp., Jamaica, N. Y. $10,000.

Concrete Gravel Co., Hattiesburg, Miss. $24,000.

North State Material Co., Asheville, N. C. E. Raynor Wilson, Thomas J. McNeil. 1,000 shares n. p. v.

McNeff Sand Co., Martinsville, Ind. L. McNeff, president, % Lloyd Insurance Co., South Bend, Ind.; L. A. McNeff, secretary-treasurer, R. F. D. No. 2, Plainfield, Ind.

Ball Bros., Ltd., Kitchener, Ont., Can. $200,000.

West Nyack Trap Rock Co., West Nyack, N. Y. J. S. Seidman, 41 Park Row, New York, N. Y. 200 shares com.

Atlantic Granite Co., 605 Capital Place, Columbia, S. C. George D. Lott, president; R. S. Campbell, vice-president; T. I. Weston, secretary. $6,000.

Copps Development Co., 333 Hartford Ave., Milwaukee, Wis. (subsidiary of Metro-Nite Corp.) Edward Copps, Edward J. Copps, Jr., Herb F. Johnson, Jr. To develop asbestos, soapstone, quartz and mica deposits at Dahlonega, Ga.

Nicolet Asbestos Mines, Ltd., 25 Broad St., New York City. C. G. Gabrielson. 200 shares com.

Eldorado Quarries, Ltd., 125 Tyndall Ave., Apt. 7, Toronto, Ont., Can. John Pait, president. $25,000.

St. Louis Portland Cement Co., % Ideal Cement Co., Denver, Colo. 1,000 shares n. p. v.

Bates International Bag Has New N. Y. Address

The Bates International Bag Co. has announced the removal of its offices to 60 East Forty-second St., New York, N. Y.

Financial News

The information contained in these financial pages is given with the understanding that any statement on the part of this magazine or any of its staff, as to the responsibility or standing of any person, firm or corporation, or as to the value of any property or securities is a mere expression of opinion, given as a matter of service to the readers of PIT AND QUARRY, *for which no responsibility in any way is to attach to this magazine or to any of its staff.*

Report Gypsum, Lime & Alabastine Profits Up

Gypsum, Lime & Alabastine, Canada, Ltd., was formerly known as Canada Gypsum & Alabastine, Ltd., but early this year changed its name to its present title. The management states that total sales in 1929 showed an increase of 33.3 per cent over 1928 and that of all plants owned during 1928 there was shown a gain of 12.8 per cent in 1929. Profits of the several lime plants taken over during the year are reflected in the table below only from the date of acquisition. It is anticipated that with a full year's operations of these plants during 1930, combined profits will show an increase over 1929.

	1929	1928
Sales	Not stated	$4,375,535
Profits	$1,315,316	977,591
Depreciation and depl.	290,663	227,181
Gross income	$1,024,653	$750,410
Interest, etc.	206,022	210,799
Income taxes	63,600	48,771
Net income	$755,031	$490,840
Dividends	450,547	206,886
Balance	$304,484	$283,954
Earned per share.	*$1.67	†$1.62

* 450,876 shares. † 303,732 shares.

The company is a large manufacturer of gypsum products and sole producer in Canada of alabastine, a large manufacturer of hydrated lime and other lime products. Mills, mines and quarries are located at various points throughout Canada. It controls in Canada the production of "Gyprock" products manufactured from gypsum. Last year the company acquired a considerable amount of additional properties, including limestone deposits, lime and stone plants.

The treasury position at the close of 1929 was satisfactory.

Capitalization at the close of the year consisted of 450,876 no-par shares of common stock with a carrying value of $6,186,000 and an equity in surplus of $530,000.

Earnings of American Aggregates Corp. Lower

American Aggregates Corp., an important producer and distributor of sand and gravel in Ohio, Michigan and Indiana, reported for the year ended December 31, 1929, net sales of $5,067,708, operating income of $1,160,909, and a net profit of $669,684, after charges, including federal taxes; compared with a net profit of $832,546 earned in the preceding year. Per-share earnings for the year 1929 amounted to $27.90 on the 7-per cent preferred, based on 24,001 shares outstanding; and to $2.24 on the common, based on 223,909 shares; as compared with $3.24 earned per common share in 1928, based on a slightly smaller number of shares outstanding.

Sales in 1928 amounted to $4,595,297, and the decline in net profit for 1928 was due to a lowering of the margin of profit to 22.8 per cent from 26.1 per cent, and to increases in both net discounts allowed and the items of interest and amortization. Tonnage sold last year was a record in the company's history—10,305,040 tons, compared with 9,266,020 tons in 1928. The company's substantial expansion in 1928 also necessitated certain readjustments and expense in consolidating new properties with American Aggregates operations.

The company's balance sheet of December 31, 1929, showed current assets of $1,060,000, including cash of $39,000, against current liabilities of $761,000.

Alpha Portland Cement Reduces Dividend Rate

Alpha Portland Cement Co. has just declared a quarterly dividend of 50 cents, payable July 25 to stockholders of record July 1. This reduces the annual dividend rate from $3 to $2.

This reduction is a reflection of the rather poor conditions prevailing in the cement industry for the past year or so. Some benefits are expected to accrue to the company as a result of the placing of a higher duty on imported cement, for Alpha Portland depends, to a large extent, upon operations along the Atlantic Seaboard. The new dividend rate was just about covered in the year ended March 31, 1930, for in that period per share earnings on the common of $2.13 were reported. As of March 31, 1930, the company was in satisfactory treasury circumstances, with current assets at $9,574,000, against current liabilities of $1,168,000, with cash and call loans amounting to $5,837,000.

Monolith Cement Omits Semi-Annual Dividend

Monolith Portland Cement Co. directors voted to omit payment of the semi-annual dividend of 40 cents on the 8 per cent cumulative preferred stock and the 40-cent semi-annual dividend on the common stock.

Officials of the company said that, due to a shrinkage of business during the first half of the year, earnings were not sufficient to warrant payment of dividends.

The company has outstanding 150,000 shares of cumulative 8 per cent preferred stock and 717,097 shares of no-par value common stock.

CURRENT DIVIDENDS

Company	Class of Stock	Dividend Rate	Holders of Record	Payable
Alpha Portland Cement	Common	$.50 qr.	July 1	July 25
American Aggregates Corp.	Preferred	1¾% qr.	June 20	July 1
Boston Sand and Gravel	Preferred	$.87½ qr.	June 22	July 1
Boston Sand and Gravel	Common	$.40 qr.	June 22	July 1
Calaveras Cement Co.	7% Pfd.	1¾% qr.	June 30	July 15
Canada Gypsum and Alabastine	Common	$.37½ qr.	June 14	July 1
Cleveland Builders Supply	Common	$.50 qr.	June 15	July 1
Consolidated Oka Sand and Gravel	Preferred	1¾% qr.	June 27	July 1
Consumers Co.	Pr. Pfd.	$1.50 qr.	June 15	July 1
Coronet Phosphate Co.		$2.00 qr.	June 14	July 1
Dolese and Shepard		$2.00 qr.	June 20	July 1
Dufferin Pav. and Crushed Stone	7% Pfd.	1¾% qr.	June 17	July 1
Ideal Cement Co.	Common	$1.75 qr.	June 13	July 1
Illinois Brick		$.60 qr.	July 1	July 15
International Salt	Common	$2.00 qr.	June 16	July 1
Johns Manville	Preferred	$1.75 qr.	June 11	July 1
Johns Manville	Common	$.75 qr.	June 25	July 15
Kelley Island Lime and Transport		$.62½ qr.	June 20	July 1
Kentucky Rock Asphalt	Common	$.40 qr.	June 15	July 1
Lehigh Portland Cement		1¾% qr.	June 14	July 1
Limestone Products	7% Pfd.	1¾% qr.	June 15	July 1
Medusa Portland Cement	Preferred	1½% qr.	June 25	July 1
Medusa Portland Cement	Common	$1.50 qr.	June 25	July 1
Metropolitan Paving Brick	Preferred	$1.75 qr.	June 15	July 1
Mineral Products Co.	Pfd. "A"	$.20 qr.	June 30	July 1
New York Trap Rock	Preferred	$1.75 qr.	June 20	July 1
Peerless Cement	Preferred	$1.75 qr.	June 20	July 1
Pennsylvania Salt	Common	$1.25 qr.	June 30	July 15
Santa Cruz Portland Cement		$1.00 qr.	June 24	July 1
Sterling Salt	Common	$.50 qr.	June 24	July 1
Superior Portland Cement	Class A	$.27½ M	June 18	July 1
Warner Co.	1st Pfd.	$1.75 qr.	June 15	July 1
Warner Co.	Common	$.50 qr.	June 30	July 15
Worcester Salt Co.	Common	1¼% qr.	June 24	July 1

Traffic News and Comment

Car-Loading Forecast

The forecast of the Shippers Regional Advisory Boards of car loadings for the third quarter of 1930 as compared with the corresponding period of 1929 shows the following:

Board	Thousand Cars Actual 1929	Thousand Cars Estimated 1930	Percentage of Decrease
Central Western.	348	347	.3
Pacific Coast.....	401	392	2.3
Pacific Northwest	316	294	6.9
Great Lakes.....	837	723	13.7
Ohio Valley.....	980	882	10.0
Mid-West	1508	1365	9.5
Northwest	768	694	9.6
Missouri-Kansas.	582	562	3.3
Southeast	853	796	6.7
Southwest	620	602	3.0
New England....	179	169	5.7
Atlantic States..	942	925	1.7
Allegheny	1082	1050	2.9
Totals.....	9415	8801	5.81

Louisiana Sand Rates

The status of the Louisiana state freight rates on sand has now been definitely determined by the finding of the United States District Court in the eastern district of Louisiana, Baton Rouge Division.

The decision of the Interstate Commerce in Docket No. 17000, part 11 (Hoch-Smith investigation) 155 I. C. C. 247, required the carriers to readjust rates on sand, gravel, crushed stone and shell within Texas, Oklahoma, Arkansas and Louisiana. States other than Louisiana made their rates conform to the decision of the Interstate Commerce Commission but Louisiana declined to do so and an order was issued specifically requiring it to do so on state traffic.

The state of Louisiana sought to enjoin, annul and set aside the I. C. C. order and the carriers asked for an injunction forbidding the state of Louisiana to interfere with the I. C. C. decision, but the Federal court denied the injunction and dismissed the proceedings and has thereby upheld the I. C. C. order as being within the scope of its authority.

Acid Phosphate

The Interstate Commerce Commission in a second report on reconsideration has modified the findings of former reports as to rates on acid phosphate from New Orleans to Carroll and Coushatta, La., that has been carried from Baltimore to New Orleans in coastwise steamship service.

The first finding was that the rate was not unreasonable or otherwise unlawful. The next finding was that the shipments prior to April 10, 1923, were overcharged to the extent that rates assessed exceeded 18½ cents, the rate to Carroll. Rates of 20½ cents and 23 cents were collected to Coushatta. The third finding is that rates were unlawful to extent that they exceeded 11½ cents, which applied on like traffic from New Orleans to Shreveport, La.

Sand and Gravel

The U. S. District Court has dismissed Case No. 563, Georgia Public Service Commission vs. United States and Interstate Commerce Commission and the bill of the Georgia Highway Commission joined with it.

The Georgia Commission sought to have the orders of the Interstate Commerce Commission in 140 I. C. C. 85 and 160 I. C. C. 309 set aside.

In Docket No. 22742, Majerus Co. vs. St. Paul, the I. C. C. has found that the rate on sand and gravel from Hawarden, Ia., to Vermillion, S. D., was unreasonable to the extent that it exceeded 3½ cents cwt.

Industrial Arts Exhibit To Be Held Sept. 14-20

Practically every line of industry and commerce will be represented in the Industrial Arts division of the 14th annual Eastern States Exposition held Sept. 14 to 20, inclusive, at Springfield, Mass., and an even greater diversity for the 1930 fall show in the industrial exhibits is indicated by the demands of manufacturers and merchandisers for exhibition space both in the indoor and outdoor display sections.

A factor of importance to exhibitors is the steady growth in Eastern States Exposition attendance. In 1928 the total attendance was 281,000 and last year this was increased to 313,000. A proportionate gain is anticipated this year, particularly in view of exceptional feature attractions, new buildings and additions to plant and equipment.

One of the outstanding characteristics of the Industrial Arts division this year will be the balance maintained in the exhibits. No one type or group will predominate. Instead there is every indication of an even wider diversity than in 1929, when approximately 421 exhibitors showed nearly 1,700 different articles. Throughout Exposition week there will be an opportunity for direct sales as well as dealer contacts.

U. S. Gypsum Will Build New Plant at Warren, O.

Warren, O., has been selected as the site for a new plant by the U. S. Gypsum Co., Chicago, where its new steel-construction division will be housed. The new plant will employ about 400 men.

Portland Cement

In Docket No. 20872, Monarch Cement Co. vs. Santa Fe & Lehigh Portland Cement Co. vs. same, the I. C. C. denied reparation on shipments of cement from Humboldt, Iola and Chanute, Kans., and Dewey, Okla., to points on the C. R. I. & P. and Pan Handle and Santa Fe in the Pan Handle section of Texas, because complainants and interveners were such in 128 I. C. C. 63 in which reparation was not asked.

Fuller's Earth

In Docket No. 22906 the Champlain Refining Co. attacks rates on fuller's earth from points in Georgia and Florida to Enid, Okla. Rates for the future and reparation are sought.

Hercules to Modernize Carthage Powder Plant

Rearrangement of plant facilities at its Carthage, Mo., explosives plant is being undertaken by Hercules Powder Co. at a cost estimated at $175,000. Thirteen small buildings in the plant area are to be replaced by nine new buildings, modern in design and equipment. Much of the cost of the project will be incurred in removal and installation of material and machinery.

Because of the company's ruling regarding the number of men working in explosives areas, contracts will not be awarded. The installation is being carried out by Hercules employes under the direction of J. S. Marks, plant superintendent of Carthage, and R. K. Hallett, construction engineer, of Wilmington, Del.

Chemical Firm Convenes at Niagara Falls Plant

The Roessler & Hasslacher Chemical Co., New York, N. Y., held its annual sales and service convention at Niagara Falls on June 9, 10, 11. In attendance were executives from the company's manufacturing plants and New York offices, district sales managers, sales and service men from various branches in the United States, Canada and Mexico. The convention was presided over by Dr. H. R. Carveth, president of the company.

Activities of the convention included inspection tours about the Niagara Falls plant, visits being made to several of the process departments. The business sessions were featured by pertinent papers discussing manufacture, service and sales of the company's products.

Review of Foreign Practice

French Gravel Plant on Lake Geneva Operating

Since 1910 the Societe Pachaud-Dupont & Cie. and its successor, the Société Anonyme pour l'Exploitation des Sables et Graviers de la Dranse, have been excavating and marketing the hard calcareous materials washed down from the Alps by the Dranse River to its mouth in Lake Geneva. Up to 1927 the materials were simply dredged from the estuary and sold as dug, with the exception that boulders over 80 mm. (3¼ in.) were screened out on the dredge and wasted. The present company, organized in 1927, has completed a large construction program that involved the building of a long embankment that protects the plant against flood stages of the river, the excavation and development of a harbor sufficient for the maneuvering of the barges hauling raw materials to and finished materials away from the plant, and the construction of a modern and well-equipped plant with a capacity of 50 cu. m. of crushed, screened and pulverized materials hourly. The plant is at Amphion-les-Bains, Haute-Savoie, France.

Four different kinds of products are made at the plant, each being further separated into a number of sizes. The natural rounded sand and pebbles are sold in sizes of 0-6 mm., 6-10 mm., 10-12 mm., 12-15 mm., 15-30 mm. and 30-40 mm. (these correspond in a general way to 0-¼, ¼-⅜, ⅜-½, ½-⅝, ⅝-1⅛ and 1⅛-1½ in. sizes), and are sold principally for plaster sand and for concrete aggregates. Crushed materials are made in sizes of 2-6 mm. (12-mesh to 4-mesh), used in the manufacture of concrete blocks, etc., and for sanding bituminous roads; 6-15 mm. (¼ to ⅝ in.), used in concrete and bituminous road construction; and 15-30 and 30-60 mm. (⅝-1⅛ and 1⅛-1⅜ in.) materials used largely for road surfacing and repairs. There are also several sizes of ground materials: 0-2 mm., 2-6 mm., 6-8 mm., 12-15 mm. and 15-20 mm., used in plastering, special coatings, and bituminous road construction. Finally there is the powder from the dust-collecting equipment, of which 59.8 per cent passes through the 4,900-mesh screen (about 175-mesh in American measurement) and all but 1.4 per cent passes through a 900-mesh screen (about 75-mesh); this material is used chiefly in bituminous mortars.

The raw material is classed as "hard blue Alpine limestone," and has a density and hardness that make it well suited for concrete and similar uses. It consists of material washed down from the Alps by the Dranse River, especially in flood stages, and deposited under favorable conditions in the natural settling basin formed at the mouth of the river on Lake Geneva. This material is dredged from the estuary, conveyed to the plant in barges, and lifted by a large electric crane to a hopper of 10-cu. m. capacity, 45 ft. above grade level.

An automatic pan feeder carries the raw material from the hopper, at the rate of 50 cu. m. per hour, to a revolving scalping screen of 46-in. diameter and 13 ft. 2 in. long, mounted on rollers without internal shaft, with two perforations of 30 or 50 mm. and 80 or 100 mm. (1.2, 2, 3.2 and 4 in., respectively). The 0 to 30 or 50-mm. material separated on the first perforation of the screen passes to a 40-in. by 56-ft. rotary screen, mounted on four sets of rollers, with six perforations giving the six sizes of rounded materials already mentioned. Inside the screen barrel, for the length of the first two sections of the screen, is a pipe which sprays water on the gravel to wash off the dirt and sand, and the third section of the screen has perforations of approximately ⅛ in., serving only to wash the material thoroughly and let the fine debris and sand escape. The sized materials are chuted from the various sections of the screen to open bin compartments below.

Material of 30 or 50 to 80 or 100 mm., passing the second perforation of the scalping screen, is chuted to a 26-in. by 12-in. jaw crusher with a discharge opening of 30 mm., producing about 10 to 12 cu. m. per hour. The rejects of the scalping screen, 4 to 10-in. boulders, are carried to another 26-in. by 12-in. jaw crusher, with an opening of 50 mm. The products of both crushers are chuted to a vibrating screen about 52 ft. long and 32 in. wide, the first section being three-decked. Material from the fine crusher falls on the first deck, perforated at 40 mm., and the oversize passes on to the remainder of the screen. Material through the 40-mm. holes drops to the second deck with 15-mm. perforations, and the rejects, material of 15-40 mm., passes laterally to a roll crusher to produce the ground products. Rock under 15-mm. falls to the third deck, which is blank, and passes on to the other sections of the screen. Material from the other jaw crusher is chuted directly to the blank section of the screen and on to the remaining sections. The crushed products from the screen are chuted to open storage bins below.

The 15-40 mm. material passes to a 38-in. by 16-in. roll crusher, and the product is lifted to a second vibrating screen, 32 in. wide and 22 ft. long, which produces the various sizes of pulverized products, oversize being returned to the rolls. The ground materials are chuted to their respective bins.

The remaining product, the fine dust, comes from a dust-collecting system consisting of a centrifugal blower which sucks dust from the various machines to a settling chamber with hopper bottom through which the dust is recovered.

Raw materials are transferred from the barges to the receiving hopper at the top of the plant by a revolving electric crane, with a travel of 16 ft., which carries a 1½-cu. m. (2-cu. yd.) clamshell bucket and has a lift of 50 ft. The plant is also equipped with an overhead traveling crane with a span of 88 ft., moving on a track 200 ft. long, carrying a 1 1/3-cu. m. (1¾-cu. yd.) clamshell bucket. This machine reclaims the finished materials from the storage compartments and carries them to the loading hoppers at the dock or to storage piles at each end of the plant.

The owners of the plant have also modernized the old dredge boat and built another more powerful and more modern. They have also built some new barges for transporting raw and finished materials. Some special barges with elevating and conveying equipment can unload their own cargoes on the docks where finished materials are delivered.

Translated and condensed from *Revue des Materiaux de Construction* (Paris), Nov., 1929, pp. 422-8.

Relative Advantages of Paper and Cloth Sacks

In a note to the Union Technique des Batiments et Travaux Publics, M. Anstett compares in a general way the sacking of cement and similar materials in paper and cloth bags. He finds that in solidity the two are in general about equal, but with an advantage to the cloth bag for withstanding snagging or great pressures when the bags are stored in high piles. In impermeability the paper sack shows a marked superiority. Either type is satisfactory for plants equipped for sewing the sacks before filling and filling through valves, but for plants that still sew the sacks after filling the paper is more likely to be torn. The paper bag, it was found, has no advantage in price because, although it is cheaper to buy, it serves only one time while the cloth bag serves eight to ten times.—*Le Ciment* 35:200-201, May, 1930.

Recent Patents

AMERICAN

Material Handling

Material-handling machine. Adolph W. Rybeck, Milwaukee, Wis., assignor to T. L. Smith Co., same place. No. 1,765,450.

Device for handling loose materials. Frederick W. Vodoz, Chicago, Ill., assignor to Goodman Mfg. Co., same place. No. 1,765,511.

Center-discharge ore car. Albert E. Zimmer, Chicago, Ill., assignor to Enterprise Railway Equipment Co., same place. No. 1,765,519.

Excavating machine. William K. Liggett, Columbus, O., assignor to Jeffrey Mfg. Co., same place. No. 1,765,682.

Dump car. Nathaniel S. Reeder, New York, N. Y., assignor to Pressed Steel Car Co., Pittsburgh, Pa. No. 1,765,700.

Back-filling attachment for excavators. George E. Wagner, Akron, O., assignor to Clutter-Wagner, Inc. No. 1,765,892.

Power-actuated trip for excavator scoops. George E. Wagner, Akron, O., and Le Roy P. Clutter, Deer Lick, Pa., assignors to Clutter-Wagner, Inc. No. 1,765,893.

Excavator. Le Roy P. Clutter, Deer Lick, Pa., assignor to Clutter-Wagner, Inc. No. 1,765,905.

Full-revolving excavator. Bird C. Clutter and George E. Wagner, Akron, O., assignors to Clutter-Wagner, Inc. No. 1,765,967.

Excavating shovel. Herman J. Brendlin, New York, N. Y., assignor to Hayward Co., same place. No. 1,766,053.

Cushion-back dipper. Walter J. Mullally, Chicago Heights, Ill., assignor to American Manganese Steel Co., Chicago, Ill. No. 1,766,255.

Miscellaneous

Bail-bracket for excavating dippers. William T. McNinch, Chicago Heights, Ill., assignor to American Manganese Steel Co., Chicago, Ill. No. 1,766,343.

Screening

Roll grizzly. Myron A. Kendall, Aurora, Ill., assignor to Stephens-Adamson Mfg. Co. No. 1,766,340.

FOREIGN

Cement and Concrete

Silicium cement and mixtures from a base of such a cement. J. Hempel. French, 686,455.

Process for making the surfaces of cement concrete watertight and unattackable by chemical agents. Etablissements Brisset et Sanua. French, 686,705.

Process for manufacture of light mortars and concrete. F. E. Marechal. French, 687,189.

Device for measuring cement for concrete mixing machines. Carl Krahn. German, 500,426.

Process for production of white cement from colored, for instance iron-bearing, raw materials. Amme-Luther Werke Braunschweig der "Miag" Muehlenbau-under Industrie-Akt.-Ges. German, 500,427.

Process for production of dolomite cements. Gustav Matschak. German, 500,138.

Process for production of hydraulic mortar material. Oskar Tetens. German, 500,139.

Crushing and Grinding

Grinding device with grinding elements pressed against a grinding ring. Hermann Hildebrandt. German, 499,699.

Intermediate chamber with sieve device for compartment mills. Chr. Pfeiffer. German, 499,880.

Improvements in pulverizer. G. Poirier. French, 687,087.

Drilling

Device for drills. Ingersoll-Rand Co. French, 687,152.

Drilling hammer. Emanuel Wagner. German, 500,151.

Rock-drilling machine. Adillo Muto. German, 500,141.

Coupling means for drills and like tools. C. S. Thomas. British, 329,269.

Dryers

Process and device for feeding rotary dryers. Zeitzer Eisengiessereiund Maschinenbau-Akt.-Ges. German, 500,147.

Process for operation of steam-heated dryers. Gewerkschaft Gustav and Dr. Ing. Ottmar Aockerblom. German, 499,785.

Drying and grinding installation. Bernhard Saegebarth. German, 499,-807.

Process for operation of revolving dryers. Max Weiss. German, 499,919.

Drying, calcining or rotary trommel. Max Weiss. German. 499,920.

Emptying device for the condensed water of steam-heated rotary dryers. Per Otto Theodor Sylwan. German, 499,991.

Firing

Boiler furnace fired with pulverized fuel. H. E. Yarrow. British, 329,395.

Apparatus for mixing air and pulverized coal. G. H. Robinson. British, 329,483.

Burners for pulverized and gaseous fuel. Societe Anonyme des Appareils de Manutention et Fours Stein. British, 316,667.

Kilns

Rotary kiln for burning cement and similar material, in which sintering and calcining take place in two kilns. Dipl.-Ing. Ludwig Eck. German, 499,721.

Bearing rollers for rotary kilns, coolers, dryers and the like. Friedrich Krupp Grusonwerk Akt.-Ges. German, 499,783.

Cooler for rotary kiln. Dr.-Ing. Niels Young. German, 499,722.

Shaft kiln. Friedrich Krupp Grusonwerk Akt.-Ges. German, 499,784.

Kiln bottoms. J. Knowles & Co. (Wooden Box) Ltd. and H. J. Taylor. British, 329,443.

Continuous kilns. C. Rost. British, 311,246.

Material-Handling

Car-dumping apparatus. H. Tacvorian. British, 329,527.

Apparatus for weighing conveyed loads. J. Chatillon & Sons. British, 318,264.

Apparatus for lubricating the bearings for the rollers of conveyors. Babcock & Wilcox Ltd. and A. Lennox. British, 329,265.

Elevator belt or bucket cleaning brushes. E. Hilton and T. Hilton. British, 329,290.

Conveyors. Igranic Electric Co., Ltd., and H. H. Rapley. British, 329,424.

Apparatus for collecting and loading material into vehicles. Preparation Industrielle des Combustibles (Soc. Anon.). British, 311,780.

Apparatus for pneumatic conveying of dust or pulverulent material, particularly pulverized coal. Friedr. Krupp Akt.-Ges. German, 500,389.

Elevating apparatus. Societe P. Tresse & Cie. French, 686,509.

Monorail. Demag Akt.-Ges. French, 686,591.

Unloading hopper car for loose materials. J. E. Greenawalt. French, 686,793.

Apparatus for pneumatic transport of granular, pulverulent and similar materials. Pneumatic Conveying & Extraction (1929) Ltd. and W. A. Smith. French, 686,131.

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Miscellaneous

Suction dredge. R. L. Aitkin. British, 329,547.

Level indicator of pulverulent materials. F. L. Schmidt & Co. (Kristian Middelboe). Canadian, 301,019.

Manufacture of concrete pipe by centrifugal force. Consolidated Pipe Co. Ltd. (assignee of La Societe des Tuyaux et Agglomeres Centrifuges). Canadian, 301,055.

Jig washers. W. Reid, R. H. Reid and W. Reid Jr. British, 329,488.

Apparatus for preparing molders' sand. G. F. Royer. British, 311,246.

Explosive compositions. Dr. A. Stettbacher. British, 312,316.

Pit and Quarry will furnish, at its actual cost, a copy of any patent cited above. A charge of ten cents per copy is made by the U. S. Patent Office, Washington, D. C., and readers may procure a copy directly by addressing the Commissioner of Patents, with payment for copies requested. Postage stamps are not accepted by the Patent office. We will endeavor to obtain copies of foreign patents for our readers but we cannot give assurance in every case for the reason that copies of such patents are not printed for distribution as liberally as are the American copies, nor is there a fixed charge per copy.

Legal Information for Operators

All Members Are Liable for Debts of Partners

The law is well established that each partner is personally liable for the debts contracted by the other partners, relating to the partnership business. Therefore, a firm who supplies materials to a partnership may collect the full amount of the account from any one partner, if the others are not financially responsible or if the Court has no jurisdiction over the other pratners.

This point of the law was discussed in the late case of Frazier v. Radford, 23 S. W. (2d) 639. In this case a material man furnished nonmetallic materials to a partnership. He sued one partner for the full amount due, and the Court promptly held this partner personally liable, saying:

"Under the common law contracts of parties were joint and not joint and several. However, our statutes have changed the common law rule and declared such contracts joint and several, so that suits may be prosecuted against any one or more of those liable."

Changed Legal Relation Relieves of Liability

It is well known that any act on the part of a material man which changes the legal relations of the contractor and material man, unknown to a surety, relieves the latter from liability. Also, any act by which a material man endeavors to change the legal status of a transaction may result in his financial loss.

For instance, in Jackson v. Federal Surety Co., 228 N. W. 400, the Concrete Engineering Co. was awarded a contract for road construction work, including some culverts and bridges. The concrete company furnished a bond guaranteeing payment for all labor and materials. During the construction work, the concrete company purchased material amounting to $4,645. The concrete company ordered more material valued at $7,415 and the seller asked the company's permission to ship the goods sight-draft attached to the bill of lading and credit $4,645 of this amount to the overdue account. The company signed an order authorizing the seller to credit his account in this manner. Subsequently the company became insolvent and the seller sued the surety to recover the amount due. However, it is interesting to observe that the Court refused to hold the surety liable for the $4,645, saying:

"The surety company never had any knowledge or notice of the arrangement which respondent (seller) attempted to make with the contractor whereby, when the shipments of material for this job were taken up by payment of sight draft against bill of lading, the proceeds of said sight draft should be first applied to the old balance due from the contractor to respondent. . . . We are entirely satisfied, under all the circumstances of this case, that, when respondent (seller) . . . shipped the materials with sight draft for the exact invoice price thereof attached to bill of lading, and the contractor paid the sight draft and took up the bill of lading and received the material, so far as appellant (surety) is concerned, respondent (seller) will not thereafter be heard to say that the payment of the sight draft was any other or different payment than a payment for the goods shipped and represented by the bill of lading."

Interpret Contract on Its Intended Meaning

A contractor is liable in damages for failure to fulfill the terms of a valid building contract. However, it is settled that a written contract always is interpreted by the Courts in accordance with the intended meaning of the contracting parties.

For example, in Menga v. Kabak, 148 Atl. 131, it was disclosed that the contract provided that "all foundation brick outside and inside up to the ground should be" stuccoed. The owner refused to pay the contractor because he failed to stucco the foundation. It is important to know that the Court held the owner bound to pay the contractor, saying:

"Clearly this provision could not mean that the walls of the cellar from its floor to its ground level should be stuccoed both outside and in, because this would involve excavating to uncover the outside of the wall and required stucco where it would serve no purpose. . . . The only way a sensible meaning can be given to this provision in the contract is to assume that 'up to the ground' was used instead of 'from the ground up'."

Court Reverses Decision of Industrial Commission

While it is true that a Court rarely will reverse a decision rendered by an Industrial Commission disallowing an employee compensation for an injury, yet this was done in the recent case of Moschogianis v. Concrete Co., 228 N. W. 607.

In this case it was disclosed that a motor truck driver 20 years of age employed by a concrete company had always been strong and healthy. One morning he began to load his truck with 140 bags of cement, weighing 95 lb. each. This loading was done from a platform practically on a level with the floor of the truck. While proceeding with the load toward his employer's place of business, 15 of these bags fell off onto a street car track. He backed the truck and, unassisted, commenced reloading the bags. Some time later he felt a sharp pain in his right groin. Thinking the pain was caused by cramps, he dismounted from the truck and endeavored to relieve the pain by walking around. This did not prove effective and, upon being examined by a physician, it was found that he had a hernia.

The concrete company attempted to avoid liability for payment of compensation for the injury on the contention that if the driver had sustained the injury when engaged in his employment he would have suffered pain. The Industrial Commission held the concrete company not liable, but the higher Court reversed this decision, and said:

"We recognize the weight that should be given to the findings of the commission. However, there was nothing inherently improbable in the evidence. The undisputed evidence as to which there can be no suggestion of improbability or inconsistency forces us to the conclusion that the decision of the majority of commissioners is wrong. Positive undisputed testimony of unimpeached, competent, and credible witnesses, can not be disregarded unless, due to its improbability or inconsistency, a reasonable ground for disregarding it appears in the record."

Contractor Held Liable for Poor Construction

In Mahan v. Springer, 283 Pac. 667, the litigation involved a contract between an owner and a contractor by the terms of which the contractor agreed to construct a concrete building. The owner sued the contractor, contending that the concrete in the building had not been properly mixed, and that the waterproofing specified in the plans and specifications had not been properly applied. The Court held the contractor liable in damages for an amount equal to the difference in the value of the building as it should have been constructed according to the plans and specifications and its value as constructed. This Court said:

"The measure of damages to the owner is what it would cost to remedy these defects; but where there is not a substantial compliance, and where to remedy the defects it is nec-

essary to tear down and rebuild large portions of the structure, the measure of damages is the difference between the value of the building as constructed and its value if it had been constructed in accordance with the contract."

Gravel Company Liable for Breach of Contract

In many instances, parties to contracts, in interpreting their obligations, forget that the Courts always endeavor to construe the intended meaning of the parties at the time the contract was made, irrespective of the clauses contained in the contract.

For example, in Morrison v. Sycamore Canyon Gravel Co., 283 Pac. 84, a gravel company entered into a contract with a man named Morrison, as follows:

"Whereas Sycamore Canyon Gravel Co. has secured the contract to furnish certain materials to Kuhn Bros. for work on the Whittier Boulevard, . . . and is desirous of obtaining the assistance of Morrison in hauling the same . . . it is agreed that Morrison shall furnish the trucks . . . hauling continuously such materials as may be required from the beginning of the work on said job until the completion thereof, and first party (gravel company) agrees to pay therefor the sum of $1.15 per five-sack . . . batch, subject to the conditions hereinafter contained . . . Payment by gravel company to Morrison is contingent upon the receipt thereof of the money for such materials so hauled."

Pursuant to this contract, Morrison purchased and procured the necessary trucks and prepared to do the hauling. Before he began to haul, the gravel company sent him the following notice: "We regret very much to have to inform you that Kuhn Bros. have cancelled their contract with us calling for the delivery of material on Whittier Blvd. It is simply a case over which we have no control. We are still selling them the material at our El Monte bunkers, but Kuhn Bros. are buying enough additional trucks to do their own hauling. We wish to thank you for the trouble that you have been to in looking up this job, and trust that this will not inconvenience you to any great extent."

Morrison demanded that the gravel company pay for the trouble and expense of purchasing motor-trucks to carry out the terms of the contract. The gravel company refused to make payment on the contention that the contract stated that payment by the gravel company to Morrison was contingent upon payment being received by the gravel company from the contractor. Morrison filed suit for damages and the lower court rendered judgment for Morrison for the sum of $3,942.75, holding that the gravel company repudiated and abandoned the contract and that Morrison was at all times ready, willing and able to perform his obligations.

The gravel company appealed to the higher court which upheld the lower court's verdict, saying:

"It is asserted that the contract of employment is conditional upon the fulfillment of another agreement with defendant (gravel company) on the part of Kuhn Bros. . . . and that this contract was subsequently cancelled by Kuhn Bros., so far as hauling the material is concerned. . . . There is no merit in this contention. The contract is definite and certain regarding the employment, the material to be hauled, and the amount of compensation for service. The only condition mentioned relates to deferred payments, from month to month, on account of a possible delay in receiving defendant's money from Kuhn Bros. A total failure to pay, on the part of Kuhn Bros. is not contemplated. In construing a contract, the intent of the parties must be determined from the terms of the agreement. In considering the present agreement as a whole, it seems quite evident the defendant himself fully expected to provide for the hauling of the material. There was no suggestion that any one else might undertake to do so."

Liability of Owner of Rented Motor Vehicle

Generally speaking, when the owner of motor trucks rents a truck and its driver for a stipulated rental per day or based upon the amount hauled, the hirer is liable for any damage effected by the driver.

For instance, in Maher v. Donk Bros. Co., 20 S. W. (2d) 888, it was disclosed that a person named Maher hired motor trucks for which he paid rental based upon a stipulated sum for each ton hauled per mile. One day Maher phoned the truck owner for a truck. The owner sent the truck with its driver and Maher instructed the driver where to deliver a load of sand. The driver unloaded the sand on the street in violation of a city ordinance. A lighted lantern was placed on the sand, but an automobile driver failed to see the light and ran into the pile, causing him to lose control of his machine, which collided with another car, seriously injuring its occupant.

It is interesting to observe that the Court held Maher liable, thus relieving the owner of the truck from responsibility, saying:

"The rule that one who employs a servant to do his work is answerable to strangers for the negligent acts or omissions of the servant committed in the course of the service is elementary. But, however, clear as the rule may be, its application to the varied affairs of life is not always easy, as the facts which place a given case within or without the rule cannot always be ascertained to a certainty. When the attempt is made to impose upon the master the liability for the consequences of the servant's neglect, it sometimes becomes necessary to ascertain who was the master at the very time of the negligent act or omission. . . . The true test in determining who the master is, in a case of this character, is not who actually did control the actions and movements of the servant in doing the work, but who had the right to control."

Usually, a motor truck driver is not personally liable for an injury caused by the truck unless he is negligent. In Morton v. Hardman-Wilkie, 147 Atl. 921, a motor truck driver parked a motor truck on a sloping lot for the purpose of unloading stone. He set the brakes, but while he was unloading the stone the truck rolled away and ran over a pedestrian. He sued the driver for damages. However, since it was not proved that the driver was aware that the brakes were defective, the Court held the employer solely liable.

Corporation's Liability for Official's Contract

It is well settled law that a corporation is bound by contracts made by its employees who act within the scope of the employment and who have proper authority. While an ordinary employee must have proper authority from an authorized manager or the directors of the corporation, the president generally is conceded to possess power to bind the corporation in all business transactions pertaining to the corporation's business.

For illustration, in the leading case of Grummet v. Fresno Glazed Cement Pipe Co., 181 Cal. 509, the Court said:

"A corporation can act only through its agents, and the president of a corporation, as the agent and corporate representative, has the power, in the ordinary course of business and in furtherance of the corporate interests, to execute contracts and to bind the company in so doing. He is, by virtue of his office, recognized as the business head of the company, and any contract pertaining to the corporate affairs, within the general powers of such officer, executed by the president on behalf of his corporation, will, in the absence of proof to the contrary, be presumed to have been done by authority of the corporation."

Offer Patent Handbook for Free Distribution

Richards & Geier, patent and trade mark attorneys, of 274 Madison St., New York, N. Y., have recently published the fifth edition of "Patents, Trade Marks and Copyrights."

The edition is for free distribution and may be obtained by writing Richards & Geier.

Insurance Problems Discussed

Explosion Damage

What would happen under your fire-insurance policies if your plant should be damaged by fire and explosion at the same time? And would it make any difference whether the fire or the explosion came first?

These questions are not given with the thought of disturbing your mind about the soundness of your present fire insurance policies. A fire-insurance policy in a good company is a valuable possession. It will give you all that should be expected of it, and will probably pay out even more liberally than the bare legal requirements. However, you should never lose sight of the fact that an insurance policy is a contract which agrees to do only the things named in it, and it is up to you as the buyer and insured to study your own problems and see that you are properly covered.

Separate Policy Needed

It should be obvious that the adjustment of any fire loss would be complicated if an explosion should occur at the same time. When an insurance policy says that it will pay for fire damage, you can hardly expect it to pay for explosions. Two things you should be on guard for in this connection, then. If your plant is damaged jointly by fire and explosion, be sure to find out promptly whether the fire or the explosion started first, and whether either was the result of the other. When an explosion comes first and causes a fire, your fire insurance policies will pay for the direct fire damage but not for the original explosion damage. When the fire comes first and causes the explosion, your fire policies will pay for the entire loss. In addition to discovering which loss occurred first, it follows that you should become informed on explosion insurance.

When a layman thinks of the possibilities of explosion about his plant, he often thinks only of steam boiler or fly wheel explosions. These, however, are a separate subject, and are outside the field of general explosion insurance. Explosions are among the most unforeseeable accidents that ever occur in a manufacturing plant. You may realize some of your principal fire risks, you may anticipate that the man working on a certain hazardous machine is likely to be hurt, but after every explosion I have ever seen, the insured's first remark has been, "Well, I never thought that was possible."

Gas Explosions

Many explosions naturally come from heating devices which are neglected or out of adjustment. Damage from steam boilers, being excluded because it forms a separate kind of insurance, is by no means the only risk. Just stop to think how many buildings are heated by something other than steam. Hot water systems, hot air furnaces, even portable kerosene stoves through oversight or careless handling may blow up and do considerable damage. A second large field for trouble lies in the variety of explosions caused by gases. Sometimes a pipe will leak, or someone may leave the valve open on a gas burner. Or noxious gases may collect in a closed room where the air does not circulate freely. Wherever gas accumulates, it needs only a spark from an electric motor or match to wreck the entire premises.

Dangers of Dust

Dust is one of our biggest risks, strange though that fact may seem. As a result of some spectacular tragedies, it is pretty widely known that grain dust is dangerous. You should appreciate, though, that most common kinds of dust will explode if properly mixed with air and exposed to any spark or light, and dusty parts of your plant should be continuously ventilated. Finally, odd accidents turn up, such as the explosion of vapors given off from a drum of gasoline—apparent trifles which are easily overlooked and seldom guarded against.

In summary, explosions generally result from dust, gases or improperly adjusted heating devices. Such an obvious risk as the handling of explosives in the insured business is given direct consideration on its merits.

Labor Trouble Covered

Explosion insurance, covering the risks in the insured's own plant as enumerated above, may be obtained in a simple form, but a broader coverage has also been developed to include damage from causes outside your plant. This is called riot-and-civil commotion insurance. The name is a formidable one, possibly tempting a facetious producer to remark that "There isn't any civil commotion around my place," but the policy is quite easy to understand. In the first place it includes all the coverage of the simple explosion policy. In addition, it covers damage due to such causes as the following:

(a) Labor trouble, whether in your own plant or elsewhere;
(b) Race riots;
(c) Strike of the fire or police departments.

It is sometimes spoken of as "bomb insurance" although bombs are not the biggest part of the risk. In estimating the risk to your own plant you should think over (1) your relations with your own workers, (2) the chances of friction with a labor union in your field, (3) the labor conditions in other plants in your vicinity, (4) race relations in your community (involving not only negroes but also foreigners who live in compact groups), and (5) the general aggressiveness of labor leaders in your territory.

This protection is inexpensive. The rates are much lower than most rates for fire, workmen's compensation, automobile and other common forms of coverage. Simple explosion insurance costs as little as five, ten or fifteen cents per $100, while the full riot and civil commotion policy usually runs from twenty to thirty cents per $100.

Unobtainable in Crises

Explosion insurance ranks next to fire and windstorm in popularity. Although still covering only a minority of all property, it is in common use and covers one of the major risks of industry. It deserves a careful study while your plant is running smoothly and you do not expect any accidents ahead. For if you should put off the matter until you are "in hot water," with a strike in or near your plant, the insurance may not be procurable, and even if you can get it you will have to pay three times the regular rate. Therefore we can recommend that you think over your risk, then drop the subject if not interested, or, if you think you may ever need such protection, buy it now when you can get it without waiting for an emergency to strike you first.

Wire-Rope Manufacture Told in Motion Picture

One of the first successful "talkie" industrial motion pictures has been produced by the American Steel & Wire Co., a subsidiary of the United States Steel Corp.

Featuring a trip through the mills in which wire rope is made, the entire process becomes not only visible on the silver screen, but the illusion of actually being present is increased by the introduction of sound.

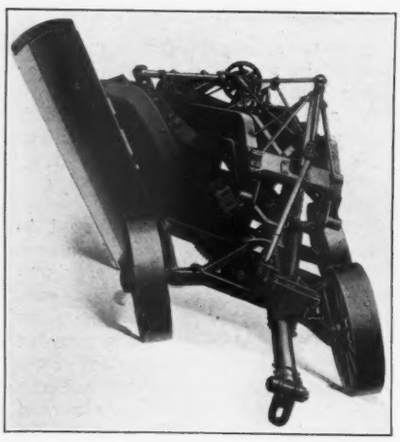
As each stage of manufacture is viewed, it is orally explained in a detailed and impressive manner. In this way, many important points of interest, impossible to cover in the usual screen captions, are conveyed to the listener.

An added and novel feature is the use of lively music at certain spots where the action does not require conversation. This combining of entertainment with educational factors has proved unusually effective in maintaining interest to the highest possible pitch.

New Machinery and Supplies

Caterpillar Announces Leaning-Wheel Grader

A new grader to team up with the Caterpillar Sixty tractor, featuring a 42-in. lateral side shift of blade that can cut a bank of 60 deg. slope, is announced by the Caterpillar Tractor Co. for July 1 delivery. This new



New leaning-wheel grader.

grader, besides introducing new features of blade control, reach and range, has also the feature of leaning wheels.

The new grader, of the leaning-wheel type, adds the fifteenth machine to a line of Caterpillar graders, maintainers, elevating graders and planers, and meets new demands for range, reach, strength and versatility for road construction. This grader is the heaviest of the Caterpillar blade graders, weighing 11,300 lb. without scarifier, and introduces a new centralized control system by which seven control wheels govern the nine important adjustments of blade pitch and position, wheel adjustment and steering.

Correct pitch of blade at all times, whether cutting or drifting, is maintained by an exclusive feature of 3-point control. The wide range and reach of blade is made possible by a 42-in. lateral side shift, by three positions of the connecting link between side shift and circle crossbar, by three blade-position connections with the blade beams and by four positions at the extensible lifting-links. The blade is thus enabled to make a high reach for bank cutting of 6 ft. 6 in. and can cut a 60-deg. slope.

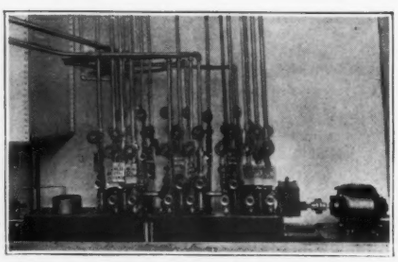
The entire lifting mechanism is mounted on roller bearings, tapered-roller bearings in worm shaft, double-row ball bearings on the lift shaft and roller bearings for the compensating lift spring sheaves.

A new construction is also introduced for the knuckle-arms of the leaning wheels whereby a steel sleeve through the knuckle holds the heavy steel pin. The sleeve also acts as a spacer for the axle angles, allowing the nut on the pin to be drawn tightly up to maintain rigidity. The knuckles pivot on the sleeve, not on the pin.

New Lubricating System Is Centrally Controlled

Herewith is pictured a centrally controlled lubricating system designed for a large, new plant in Oregon, by the Hills-McCanna Co., Chicago.

The equipment consists of one regular 24-pint, 30-feed, motor-driven lubricator and one regular 22-feed motor-driven lubricator. The two units combined make a total of 52 feeds or "oil leads" in all. Two 50-gallon storage tanks are provided to feed oil to lubricators by gravity. The flow of oil is automatically regulated and fed from the large, central-supply tank. The arrangement makes an ideal system; as replenishment of the oil supply to



Multiple force-feed lubricator.

lubricator reservoirs are mechanical and fillings are eliminated. An oiling crew is likewise dispensed with.

The advantages of lubricating from a central point are not confined to any one industry. Various types of manufacturing plants where several bearings, cylinders, rolls, and other points requiring positive force-feed lubrication, are located in close proximity can be lubricated through Hills-McCanna force-feed lubricators.

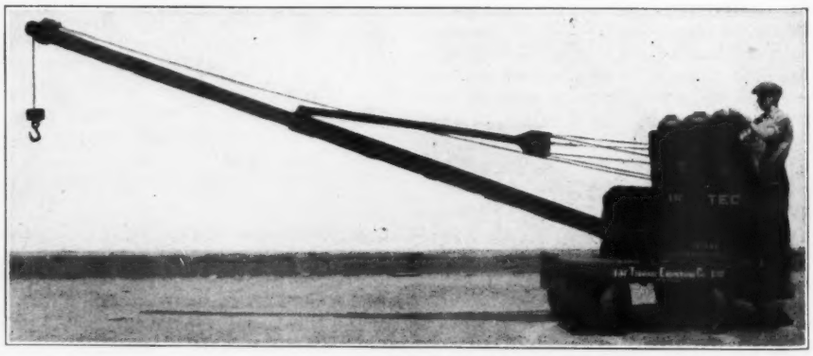
Build Heavy-Duty Crane With A Telescopic Boom

A new type of heavy-duty crane, suitable for indoor or outdoor use, has recently been placed on the market by the Terminal Engineering Co., New York. The capacity of this crane is 3,650 lb. at a distance of 2 ft. from the end of the chassis, or 750 lb. at a distance of 14 ft. from the end of the chassis. The boom is telescopic over a distance of 6 ft. The boom and hook are operated independently from two separately driven hoist units, each with its own motor and controller. Applications of this machine are readily found in any place where it is desired to make use of all available space, where crowded conditions make easy maneuverability a vital point, and in jobs where it is necessary to have a long reach horizontally as well as vertically.

The four-wheel drive with no mechanical differentials, but with a motor on each wheel, gives a maximum amount of traction.

In order to give a maximum counter-balancing effect, the machine is so designed as to concentrate as much weight as possible over the wheels away from the load. However, in cases where the load is great enough to throw nearly all the weight on the wheels near the hook, thus reducing the traction on the other wheels, the crane still has motive power because all wheels are driven by individual motors. The usual two-wheel drive truck cranes are not thus equipped to carry heavy loads. When the wheels at the driver's end tend to leave the ground, the two-wheel drive machine loses the major part of its traction.

Power is supplied to the crane from a storage battery which is large enough to operate an electric magnet, as well as to perform the propelling and hoisting duties. The battery is carried in one unit in a steel container and can be changed easily by the driver using an overhead hoist.



Portable crane with telescopic boom.

Manganese-Steel Plate Saves Dipper-Door Wear

Operators of power shovels will be interested in the accompanying illustrations, which show a dipper door made of manganese-steel plate.

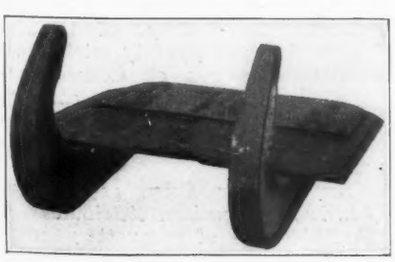
This particular dipper door is for one of a number of 4 cu. yd. shovels used by the Dolese & Shepard Co. in the quarrying operations at the company's crushed-stone plant near Chicago, Ill. The stone is a limestone and, although explosives are used to break it up, the pieces handled are

Manganese-steel dipper door.

fairly large and heavy. This caused a great deal of breakage to as well as wear on the dipper doors, and necessitated frequent replacements and considerable expense, together with shutdowns of the shovels while the dippers were being repaired.

No solution of these difficulties was obtained until the dipper doors were equipped with manganese-steel plates. The main part of each dipper door is made of two pieces of manganese-steel plate 53 in. square and ½ in. in thickness. These pieces are joined together by countersunk rivets and then riveted to the hinge arms. The end portion of each door is reinforced with a ¾-in. liner plate made of two pieces of ⅜-in. manganese-steel plate, manufactured by the Manganese Steel Forge Co., Philadelphia, Pa.

Since equipping the first dipper with this plate, several of the shovels operated by the Dolese & Shepard Co. have been fitted out in the same manner, and some of them have been operated over a year without requiring replacements. This is due, it is claimed by the manufacturer, to the unusual wear-resisting qualities of rolled manganese-steel plate, and to its great toughness and tensile strength, which practically eliminates breakage.



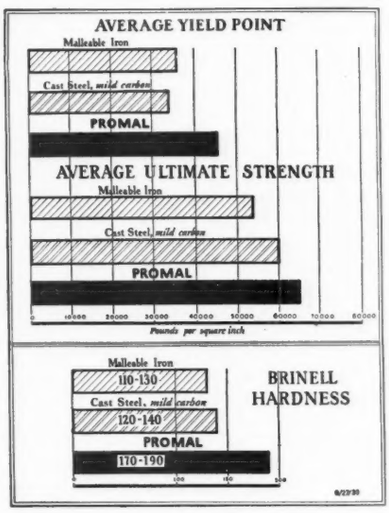
Another view of the door.

Develop Casting Metal for Industrial Chains

A new line of cast chains showing remarkable strength and durability in comparison with malleable chains has been placed on the market by the Link-Belt Company, Indianapolis. These chains are sold under the registered trade name of PROMAL.

They are the result of extended research to provide longer life for drive and conveyor chains operating under heavy loads or abrasive conditions. Experimentation with cast chain metals, started about four years ago, led to the discovery of a new method of processing malleable iron which so altered its physical characteristics as to make it a distinctly new metal. This fact was recognized by giving it the distinctive name of "Promal."

Compared with malleable iron, Promal has an average yield point of 45,000 lb. as against 36,000 lb.; an average ultimate strength of 65,000 lb. as against 54,000 lb.; an average elongation of 14 per cent as against 18 per cent; and a Brinell hardness of 170 to 190 as against 110 to 130. Compared with mild cast steel, annealed, Promal has an average yield point of 45,000 lb. as against 34,000 lb.; an average ultimate strength of 65,000 lb. as against 60,000 lb.; an average elongation of 14 per cent as against 26 per cent; and a Brinell hardness of 170 to 190 as against 120 to 140.



Yield point, strength and hardness of chain metal.

Promal thus has, to a high degree, the qualities desirable in sprocket chain material; great toughness to resist extreme tension without permanent stretch; high strength in proportion to weight and size; and hardness that affords great resistance to abrasive wear. The combination of these characteristics in the new metal gives chains made of it their surprising durability.

Due to their higher Brinell hardness, Promal chains withstand abrasive wear far better than the usual cast chain. It is also worthy of note that Promal has an exceptionally high yield point or elastic limit (25 per cent higher than that of average malleable iron), which engineers recognize as of greater importance than ultimate strength. In addition to having this high yield point, Promal metal is tough and ductile so that it withstands shock and fatigue loads. High temperature reduces its tensile properties somewhat, but temperatures up to 1,000 deg. F. will not cause it to become brittle.

Chain link made of new wear-resisting iron.

Although laboratory tests indicated the better wearing qualities of Promal chains when they were first developed, they were withheld from the open market for over three years to permit extensive field tests. For these tests many chains were tried out in various industries through the co-operation of Link-Belt customers. A check was then kept on the performance of Promal chains while subjected to every-day usage. The results have uniformly sustantiated the laboratory tests.

For example, one Promal chain in a Pennsylvania cement mill, running night and day in an atmosphere saturated with cement dust, has already lasted more than twice as long as the malleable chain used before and shows no evidence of serious wear.

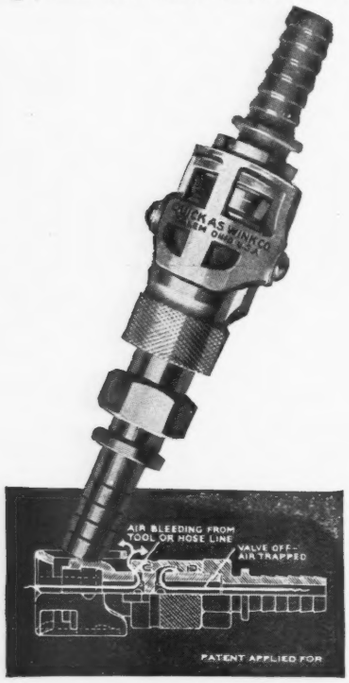
In an Ohio plant a Promal chain driving a tumbling barrel has lasted six times as long as the malleable chain it replaced and is still in operation. This particular drive affords a hard test because of the short center distance of 4 ft. between sprocket shafts, the large ratio of reduction (from a 13-tooth driving-sprocket to a 78-tooth driven wheel) and an irregular, jerky load.

By-Pass Principle Used in New Shut-off Valve

C. B. Hunt & Co., Salem, O., announces a new application of the by-pass principle which is incorporated in the Quick-as-Wink shut-off valve and coupling which it has recently placed on the market.

A ¼-in. push or pull on the outer member is the only movement required to turn the flow of air on or off.

In combination with these couplings, this new valve allows air to



Shut-off valve and coupling.

be shut off anywhere on the hose line, automatically bleeding air for removal of tools for repairs or oiling.

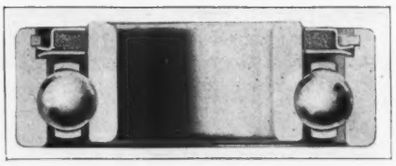
The claim is made that, in spite of the free-swiveling of coupling and valve, they are air tight at air pressures varying from 1 oz. to 1,000 lb.

All sizes of these units are manufactured from ¼-in. to 4-in., and to fit all usual types of hose or pipe connections.

Develops New Design of Felt-Seal Ball Bearing

SKF Industries, Inc., has developed a new type of patented felt-seal ball bearing possessing a number of distinctive features which mark a radical improvement in this type of bearing. A felt seal is provided as an integral part of the bearing, thus making it necessary for the machine manufacturer to provide only one housing enclosure.

The outer and inner races as well as the balls in the bearing are made of high-carbon, chrome alloy steel, hardened throughout. The bore and outside diameter are ground to international standard dimensions and tolerances, the same as the corresponding standard single-row bearings. The width, however, is slightly greater than the standard dimension of a single-row bearing in order to accommodate the felt seal. The tolerances on eccentricity of the outer and inner races are also international standard tolerances for single row ball bearings.



New felt-seal ball bearing.

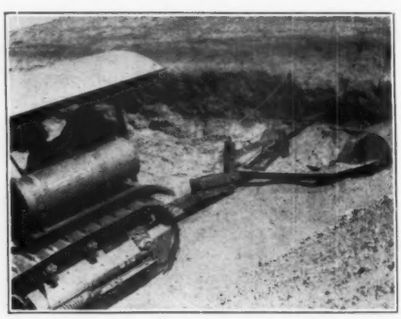
The inner race projects a little beyond the face of the seal in order that the bearing may be pulled off the shaft at any time without the possibility of damaging the seal plates.

The seal consists of an inner steel plate which is dished at its periphery and bears against a shoulder formed on the outer race. A removable felt of substantial size comes next, then a dished-steel end plate, after which a split-steel ring is fitted into a groove in the outer race to hold the assembly in place. An idea of the construction and the relation of the various parts can be gained by reference to the cross-sectional view shown here.

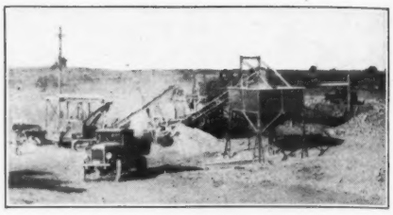
An outstanding feature of the design is the ease with which the seal may be disassembled at any time and new felts applied. To disassemble the seal, it is merely necessary to spring the split-steel ring out of the groove in the outer race, after which all the other component parts of the seal may be readily lifted out. The entire procedure of disassembling and reassembling is only a matter of a few minutes time.

Use Tractors to Build Highway in New Mexico

Many interesting functions are being performed by Caterpillar tractors in non-metallic mineral operations. One of these instances was in connection with a hurry-up project of road building in New Mexico. Armstrong & Armstrong, contractors of Roswell, N. M., found it necessary to install a temporary outfit in what is known as Dark Canyon while building the highway to the famous Carlsbad caverns. Operations were conducted both night and day because of the desire to complete a certain section of the road before cloudbursts could wreck the plant. The tractor was used instead of the customary mules in removing overburden with a Killifer scraper. The stripped material was crushed to be used as road material, with the underlying gravel.



Tractor and scraper removing overburden.



View of the Armstrong plant.

Detachable Bit Makers Buy Jersey City Plant

The Detachable Bit Corporation of America, 25 Broadway, New York, N. Y., has recently purchased the entire plant and property of the New York Drop Forging Co., located at 301 West Side Ave., Jersey City, N. J., and will move their offices and executive force to that location about the 1st of July.

One of the articles which will be made at the new location is the Thurston detachable bit, which has been approved in operation by some 350 users, and the company expects to increase the production, at present 2,000 bits per day, to 10,000 per day. A special alloy steel is used, carefully heat-treated and inspected, so that extreme hardness and durability is assured.

The following advantages are claimed for the Thurston bit: One-tenth transportation cost; no sharpening; uniformity; greater drillability; greater anti-fatigue characteristics; satisfied drillers; increased production; administrative relief.

The officers of the company are: J. F. Strough, president, formerly secretary and treasurer of the Timken Roller Bearing Corp.; J. B. Shearer, chairman of the board; C. B. Langstroth, vice-president, formerly with the A. O. Smith Co., of Milwaukee, Wis., as chief metallurgist.

Harnischfeger Corp., Ltd. Opens Canadian Offices

Harnischfeger Corp. of Canada, Ltd., which was recently established, with headquarters at Ottawa, announces the opening of an office at 504 Dominion Square Building, Montreal. L. P. Deephouse is district manager in charge.

Harnischfeger Corp. of Canada, Ltd., is the Canadian distributor for the P&H Line of excavating equipment and overhead traveling cranes and hoists.

Manufacturers' Publications

Each publication listed below contains information of interest to non-metallic mineral producers. Readers may obtain, without charge—except where a price may be stated—and without obligation, copies of any of these publications by writing directly to the manufacturers who publish them. Please mention PIT AND QUARRY *when writing.*

Cableways

Working a Pit of Coarse Gravel. 20 p., 33 ill. (*Sauerman News* for June, 1930. Sauerman Bros., Inc., Chicago, Ill.) Digging sand and gravel on a 1,300-ft. span; many uses of cableways in construction of dams; power scraper method of removing slush from ice planer; reserve storage of coal for an industrial boiler plant.

Cars

Biehl Industrial Cars and Equipment. 80 p., 107 ill. (Catalogue No. 9. The Biehl Iron Works, Inc., Reading, Pa.) A complete line of industrial V-type side-dump cars; bottom-dump buckets; tar and asphalt heaters; stoves, wheelbarrows, portable furnaces and, in short, a complete line of intraplant transportation accessories.

Biehl Ready-Mixed Concrete Conveyor. 2 p., 5 ill. (Folder, Biehl Iron Works, Inc.. Reading, Pa.) Describes and gives dimensions of a ready-mix conveyor mounted on a truck chassis.

Biehl Creeper Dump Wagon. 8 p., 10 ill. (Folder, Biehl Iron Works, Inc., Reading, Pa.) 2 p., 5 ill. Describes steel dump wagon equipped with creeper tread for moving heavy loads regardless of road conditions.

Conveyors

The Airveyor. 4 p., 9 ill. (Folder. Fuller Co., Catasauqua. Pa.) Interesting close-ups of suction equipment applied to unloading vessels at an elevator; portable unit discharging ships directly to cars; suction hose discharging car of soda ash; swiveled duct over loading platfrom to avoid interference.

Concrete

Fifty-Eight Years. 31 p., 26 ill. (*The Warner-American News* for June, 1930. Warner Co., and American Lime & Cement Co., Philadelphia, Pa.) Describes Wilmington's south-side plant; the big well shot at Union Furnace Quarry; the plant in Central Pennsylvania Mountains. Interesting articles and close-ups.

Cranes

"29-Year-Old 'American' Crane Works Shoulder to Shoulder with Brand New 'Americans' at Houston Plant of the T. & N. O. Railroad." 4 p., 11 ill. (*American Ditcher Scoopings* for June, 1930. American Hoist & Derrick Co., St. Paul, Minn.) Gives long life figures on various types of cranes and shovels.

Drilling

"Blast Loosens 110,000 cu.yd. of Rock." 8 p., 14 ill. (*The Armstrong Driller* for June, 1930. Armstrong Mfg. Co., Waterloo, Ia.) Several newsy items on plants and drills in various locations.

Electrical

"Old Man Business." 13 p., 7 ill. (*Trumbull Cheer* for June, 1930. Trumbull Mfg. Co., Plainville, Conn.) New developments in the Trumbull line of switch cabinets, panels, fuse boxes and notice of price reductions covered. Two pages from new catalogue reproduced.

Graders

Caterpillar Leaning Wheel Graders. 32 p., 43 ill. (Catalogue. Caterpillar Tractor Co., San Leandro, Calif.) Describes completely a new grader having front and rear axles so arranged that grader may be set in a ditch at an angle permitting the use of the blade at any other angle desired while the chassis remains practically level.

Tanks

"Heil-Built Aluminum Equipment." 4 p., 14 ill. (*Heil News* for June, 1930. The Heil Co., Milwaukee, Wis.) Describes use of aluminum in the construction of dump trucks.

Tractors

Hyster Caterpillar Tractors. 8 p., 43 ill. (Bulletin. Willamette-Ersted Corp., Peoria, Ill., and Portland, Ore.) Gives data on tractors equipped with hoists for all kinds of construction work.

Trucks

The Story of Relay. 36 p., 30 ill. (Bulletin. Relay Motors Corp., Lima, O.) Explanation of the Relay principle of horizontal cushioning. Instructive data of this method of using gravity to assist in starting heavy loads and using the bumps on bad roads to reduce hauling costs.

Valve Coupling

Quick as Wink. 4 p., 14 ill. (Folder. C. B. Hunt & Son, Salem, O.) The description of a new application of the by-pass principle applied to swivel-type air-hose couplings in which the coupling acts as a shut-off valve if it is desired to remove tools or make changes.

Welding

"A New Lease on Life." 19 p., 35 ill. (*Oxy-Acetylene Tips* for July, 1930. Linde Air Products Co., New York, N. Y.) Usually valuable information in connection with the welder's problems.

"Welding Unbeveled Plates." 12 p., 9 ill. (*The Fusion News* for July, 1930. Fusion Welding Corp., Chicago, Ill.) Describes electric welding, cutting, nomenclature and symbols with suggested standards to be used in connection with the design of welded structures. Technical data on the control of electric-welded joints.

Firms Merge with North American Refractories

The North American Refractories Co. of Cleveland, O., has announced its acquisition of the United States Refractories Corp. of Mt. Union, Pa., and of the Savage Mountain Fire Brick Co.

The North American Refractories Co. came into existence March 1 of last year by the consolidation of the following companies: Ashland Fire Brick Co., Ashland, Ky.; Crescent Refractories, Curwensville, Pa.; Dover Fire Brick Co., Strasburg, O.; Elk Fire Brick Co., St. Marys, Pa.; Farber Fire Brick Co., Farber, Mo.; and the Queens Run Refractories, Inc., Lock Haven, Pa.

Previous to acquiring the two new concerns the company owned fifteen plants, located in Pennsylvania, Kentucky, Ohio and Missouri, with a combined annual capacity of approximately 155,000,000 fire brick. The purchase of the United States Refractories and the Savage Mountain Fire Brick increases the capacity to approximately 200,000,000 refractories per year.

The general offices of the company are located in the National City Bank Bldg., Cleveland, O., while district sales offices are maintained in Boston, New York, Philadelphia, Buffalo, Pittsburgh, Chicago, St. Louis, and Hamilton, Canada.

Schweitzer & Conrad Is Sold to Cutler-Hammer

Announcement is made by Cutler-Hammer, Inc., Milwaukee, Wis., that on July 1 it acquired all common stock of Schweitzer & Conrad, Inc., Chicago, manufacturers of high-voltage equipment.

Schweitzer & Conrad will continue to operate as an independent manufacturing and selling unit. No changes in organization or personnel will be made, except Beverly L. Worden, president of Cutler-Hammer, has also been elected president of Schweitzer & Conrad.

Mr. Conrad and Mr. Schweitzer have been retained as consulting engineers and will continue their interest in the management as members of the board of directors.

Other members of the new Schweitzer & Conrad board are F. R. Bacon, who is chairman of the Cutler-Hammer board, and F. L. Pierce and Louis A. Lecher, who are also members of the Cutler-Hammer board.

Fuller Lehigh Co. Opens Sales Office in Atlanta

Announcement has been made by the Fuller Lehigh Co., manufacturers of pulverized-coal firing equipment and water-cooled furnace walls, of the opening of a new sales office in the Candler Building at Atlanta, Ga. J. McC. Hill is in charge.

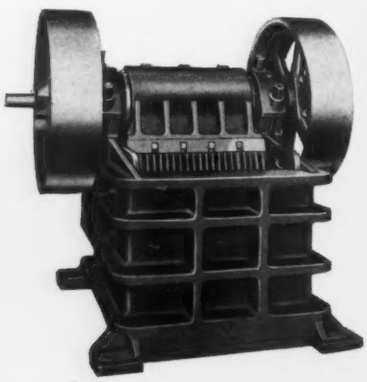
Does Your Crusher

run a full season without shut-down? No? Then you should know about *one* of the new construction details in the Wheeling Roller Bearing Crusher which absolutely guarantees long life and continuous crusher service.

A DUST GUARD THAT WORKS

Pictured above is a Dust Guard, which permits lubrication of the toggle joint, completely excluding all dirt, dust, grit, etc. Result is the greatly increased life of the toggle joint, which should allow a full season's run without shut-down. A dry toggle joint usually requires attention about every two weeks, and lubrication without dust and dirt protection is hopeless. The Wheeling Dust Guard has solved the problem of uninterrupted crusher operation, simply and effectively.

May We Tell You More?



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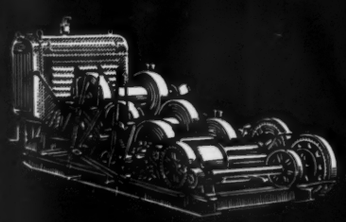

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When you gear your crusher operation to a fast, steady Bucyrus-Erie quarry shovel, you are banking on a veteran—a shovel that's in its element in tough rock digging.

Every detail is quarry tested—special rock dipper—powerful boom—heavy duty crowd, hoist and swing machinery, revolving frame and caterpillar mounting. Every part is built of the finest steels and designed with an understanding of quarry demands and limitations.

This means to you what it means to hundreds of others—many years of dependable service, whole seasons without a mishap, negligible repair bills, output not approached by ordinary shovels, a consistent downward trend of digging costs.

With a choice of 2, 2 1/2, 3, 4 and 5-yard, electric or steam, there is a Bucyrus-Erie quarry shovel exactly suited to your needs. We suggest that you visit one of these machines—you won't have to go far—and see for yourself the mechanical refinements back of its brilliant performance.

Name the size and power you need and we'll send a complete description by return mail.

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